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SEARCH REQUEST FORM

Scientific and Technical Information Center

Requester's Full Name: Wesley Markham Examiner #: 74552 Date: 1/15/04
 Art Unit: 1762 Phone Number 301-272-1422 Serial Number: 09/239,477
 Mail Box and Bldg/Room Location: REM 8D60 Results Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.

 Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: Method of Processing a Nanotube
 Inventors (please provide full names): Yuegang Zhang (Assignee = NEC Corp)

Earliest Priority Filing Date: 12/17/1999

For Sequence Searches Only Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.

Please search (claims 1-34 =>) the process involves taking nanotubes (e.g. in an organic solvent dispersion), ~~app~~ applying the nanotubes to a solid substrate (e.g. metal or semiconductor) with an edge or holes in it, heating the substrate to cause a reaction between the substrate and nanotubes, and separating/cutting the nanotubes from the substrate and reaction product in order to define ends/tops of the nanotubes. The nanotubes can be carbon ~~or~~ or boron nitride based.

Nanotube synonyms: CNT, MWNT, SWNT, MWNT, SWCNT, buckytube, nanofiber, nanofilament, ~~SWNT~~ Fullerene tube, etc.

Thanks a lot, Wes

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	Type of Search	Vendors and cost where applicable
Searcher: <u>Ed</u>	NA Sequence (#) _____	STN <u>\$ 255.39</u>
Searcher Phone #: _____	AA Sequence (#) _____	Dialog _____
Searcher Location: _____	Structure (#) _____	Questel/Orbit _____
Date Searcher Picked Up: _____	Bibliographic <input checked="" type="checkbox"/>	Dr. Link _____
Date Completed: <u>1-16-04</u>	Litigation _____	Lexis/Nexis _____
Searcher Prep & Review Time: <u>15</u>	Fulltext _____	Sequence Systems _____
Clerical Prep Time: _____	Patent Family _____	WWW/Internet _____
Online Time: <u>130</u>	Other _____	Other (specify) _____

Pf-2727/nec/us/mh

ABSTRACT OF THE DISCLOSURE

5 The present invention provides a method of processing a nanotube, comprising the steps of : causing a selective solid state reaction between a selected part of a nanotube and a reactive substance to have the selected part only become a reaction product ; and separating the nanotube from the reaction product to define an end of the nanotube.

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What is claimed is :

1. A method of processing at least a nanotube, comprising the steps of :
 - 5 causing a selective solid state reaction between a selected part of a nanotube and a reactive substance to have said selected part only become a reaction product ; and
separating said nanotube from said reaction product to define an end of said nanotube.
- 10 2. The method as claimed in claim 1, wherein said step of causing a selective solid-state reaction further comprises the steps of :
 - selectively contacting said ~~part~~ of said nanotube with said reactive substance ; and
 - 15 causing said selective solid state reaction on a contacting region of said selected part of said nanotube and said reactive substance to have said selected part only become said reaction product,
wherein a boundary between said reaction product and said nanotube is self-aligned to an edge portion of said contacting region of said
20 selected part of said nanotube and said reactive substance.
3. The method as claimed in claim 2, wherein said solid state reaction is caused by heating said reactive substance.

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4. The method as claimed in claim 3, wherein said reactive substance is heated by an irradiation of a heat ray onto said reactive substance.
- 5 5. The method as claimed in claim 4, wherein said heat ray is an infrared ray.
6. The method as claimed in claim 3, wherein said reactive substance is heated by applying a current between said reactive substance and said nanotube.
10
7. The method as claimed in claim 2, wherein said step of contacting said part of said nanotube with said reactive substance further comprises the steps of :
15 dispersing said nanotube into an organic solvent to form a dispersion liquid ;
 applying said dispersion liquid onto a surface of said reactive substance ; and
 evaporating said organic solvent from said dispersion liquid to
20 leave said nanotube on said reactive substance.
8. The method as claimed in claim 3, wherein said nanotube is separated from said reaction product by rapidly cooling said reaction product.

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9. The method as claimed in claim 1, wherein said nanotube is a single-layer winded nanotube.
- 5 10. The method as claimed in claim 1, wherein said nanotube is a multi-layer winded nanotube.
11. The method as claimed in claim 1, wherein said nanotube is a carbon nanotube.
- 10 12. The method as claimed in claim 1, wherein said nanotube is a boron nitride based nanotube.
- 15 13. The method as claimed in claim 1, wherein said reactive substance is a metal.
14. The method as claimed in claim 13, wherein said reactive substance is Nb.
- 20 15. The method as claimed in claim 1, wherein said reactive substance is a semiconductor.
16. The method as claimed in claim 15, wherein said reactive substance is Si.

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17. The method as claimed in claim 11, wherein said reactive substance is in a solid state.
- 5 18. The method as claimed in claim 17, wherein said reactive substance comprises a substrate having an edge.
19. The method as claimed in claim 18, wherein said edge is defined by a hole formed in said substrate.
- 10 20. The method as claimed in claim 1, wherein said end of said nanotube is a top of said nanotube.
21. A method of forming a top of a carbon nanotube, comprising the
- 15 steps of :
- selectively contacting a selected part of a nanotube with a solid state reactive substance having an edge ;
- carrying out a heat treatment to said solid state reactive substance to cause a selective solid state reaction on a contacting region of said
- 20 selected part of said nanotube and said solid state reactive substance to have said selected part only become a reaction product, wherein a boundary between said reaction product and said nanotube is self-aligned to said edge of said solid state reactive substance ; and
- separating said nanotube from said reaction product to define a

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top of said nanotube.

22. The method as claimed in claim 21, wherein said solid state
reactive substance is heated by an irradiation of a heat ray onto said solid
5 state reactive substance.

23. The method as claimed in claim 22, wherein said heat ray is an
infrared ray.

10 24. The method as claimed in claim 21, wherein said solid state
reactive substance is heated by applying a current between said solid state
reactive substance and said nanotube.

25. The method as claimed in claim 21, wherein said step of
15 contacting said selected part of said nanotube with said reactive substance
further comprises the steps of :

dispersing said nanotube into an organic solvent to form a
dispersion liquid ;

20 applying said dispersion liquid onto a surface of said solid state
reactive substance ; and

evaporating said organic solvent from said dispersion liquid to
leave said nanotube on said solid state reactive substance.

26. The method as claimed in claim 21, wherein said nanotube is

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separated from said reaction product by rapidly cooling said reaction product.

27. The method as claimed in claim 21, wherein said nanotube is a
5 single-layer winded nanotube.

28. The method as claimed in claim 21, wherein said nanotube is a
multi-layer winded nanotube.

10 29. The method as claimed in claim 21, wherein said nanotube is a
carbon nanotube.

30. The method as claimed in claim 21, wherein said nanotube is a
boron nitride based nanotube.

15 31. The method as claimed in claim 21, wherein said solid state
reactive substance is a metal.

32. The method as claimed in claim 31, wherein said solid state
20 reactive substance is Nb.

33. The method as claimed in claim 21, wherein said solid state
reactive substance is a semiconductor.

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34. The method as claimed in claim 33, wherein said solid state reactive substance is Si.



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Bib Data Sheet

CONFIRMATION NO. 9526

SERIAL NUMBER 09/739,477	FILING DATE 12/18/2000 RULE	CLASS 428	GROUP ART UNIT 1772	ATTORNEY DOCKET NO. NEC NPF-2727	
APPLICANTS Yuegang Zhang, Tokyo, JAPAN;					
** CONTINUING DATA ***** N/A WA					
** FOREIGN APPLICATIONS ***** JAPAN 11-359579 12/17/1999 WA					
IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 02/23/2001					
Foreign Priority claimed <input checked="" type="checkbox"/> yes <input type="checkbox"/> no		STATE OR COUNTRY JAPAN	SHEETS DRAWING 4	TOTAL CLAIMS 34	INDEPENDENT CLAIMS 2
35 USC 119 (a-d) conditions met <input checked="" type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> Met after Allowance WA					
Verified and Acknowledged Examiner's Signature _____ Initials _____					
ADDRESS Norman P. Soloway HAYES, SOLOWAY, HENNESSEY, GROSSMAN & HAGE, P.C. 175 Canal Street Manchester, NH 03101					
TITLE Method of processing a nanotube					
FILING FEE RECEIVED 962	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:		<input type="checkbox"/> All Fees		
			<input type="checkbox"/> 1.16 Fees (Filing)		
			<input type="checkbox"/> 1.17 Fees (Processing Ext. of time)		
			<input type="checkbox"/> 1.18 Fees (Issue)		
			<input type="checkbox"/> Other _____		
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=> file home
FILE 'HOME'

=> display history full 11-

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FILE 'LCA'
L1      0 SEA NANOTUBE# OR NANOTUBING# OR NANOTUBUL? OR NANOFIBER?
        OR NANOFIBRE? OR NANOFILAMENT? OR NANOSTRAND? OR
        NANOTHREAD? OR NANOWIRE# OR NANOWIRING# OR NANORIBBON?
        OR NANO(A)(TUBE# OR TUBING# OR TUBUL? OR FIBER? OR
L2      0 SEA NANO(A)(WIRE# OR WIRING#) OR CNT OR MWNT OR SWNT OR
        MWLNT OR MWCNT OR MCWNT OR SWCNT OR SCWNT OR SLWNT OR
        SWLNT OR BUCKYTUBE# OR BUCKYTUBING# OR BUCKYTUBUL? OR
        FULLERENETUBE# OR FULLERENETUBING# OR FULLERENETUBUL? OR
        (BUCKY OR FULLERENE#)(2A)(TUBE# OR TUBING# OR TUBUL?)

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L3      16768 SEA L1 OR L2 OR NANOTUBE#
L4      2191 FILE WPIX
L5      2126 SEA L1 OR L2 OR NANOTUBE#
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L8      1321 SEA (SOLIDSTATE# OR SOLID?(2A)STATE# OR HETEROG?)(3A)(REA
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L9      229 FILE JAPIO
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L13     37 FILE JAPIO
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FOUNDATION? OR PANE? OR DISK? OR DISC# OR WAFER?)

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L20 1 SEA SILICON/CN
E NIOBIUM/CN
L21 1 SEA NIOBIUM/CN

FILE 'HCA, WPIX, JAPIO'

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SEMICOND? OR SEMI(A) (COND# OR CONDUCT?)) (2A) (SUBSTRAT?
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WAFER?)

TOTAL FOR ALL FILES

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UNDERLAY? OR FOUNDATION? OR PANE? OR DISK? OR DISC# OR
WAFER?)
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FOUNDATION? OR PANE? OR DISK? OR DISC# OR WAFER?)
L27 152754 SEA (METAL#### OR SOLID?) (2A) (SUBSTRAT? OR SURFACE? OR
BASE# OR SUBSTRUCT? OR UNDERSTRUCT? OR UNDERLAY? OR
FOUNDATION? OR PANE? OR DISK? OR DISC# OR WAFER?)

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BASE# OR SUBSTRUCT? OR UNDERSTRUCT? OR UNDERLAY? OR
FOUNDATION? OR PANE? OR DISK? OR DISC# OR WAFER?)
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OR UNDERLAY? OR FOUNDATION? OR PANE? OR DISK? OR DISC#
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BSTRAT? OR SURFACE? OR BASE# OR SUBSTRUCT? OR UNDERSTRUCT?
OR UNDERLAY? OR FOUNDATION? OR PANE? OR DISK? OR DISC#
OR WAFER?)

L34 31 SEA L11 AND (L7 OR L16 OR L22 OR L26 OR L30)

L35 17 SEA L12 AND (L8 OR L17 OR L23 OR L27 OR L31)

L36 2 SEA L13 AND (L9 OR L18 OR L24 OR L28 OR L32)
TOTAL FOR ALL FILES

L37 50 SEA L14 AND (L10 OR L19 OR L25 OR L29 OR L33)

L38 24 SEA L3 AND L7

L39 6 SEA L4 AND L8

L40 0 SEA L5 AND L9
TOTAL FOR ALL FILES

L41 30 SEA L6 AND L10

L42 162 SEA L3 AND L16

L43 29 SEA L4 AND L17

L44 2 SEA L5 AND L18
TOTAL FOR ALL FILES

L45 193 SEA L6 AND L19

L46 1015 SEA L3 AND L22

L47 121 SEA L4 AND L23

L48 28 SEA L5 AND L24
TOTAL FOR ALL FILES

L49 1164 SEA L6 AND L25

L50 358 SEA L3 AND L26

L51 136 SEA L4 AND L27

L52 22 SEA L5 AND L28
TOTAL FOR ALL FILES

L53 516 SEA L6 AND L29
 L54 12 SEA L3 AND L30
 L55 0 SEA L4 AND L31
 L56 0 SEA L5 AND L32

TOTAL FOR ALL FILES

L57 12 SEA L6 AND L33
 L58 38 SEA L42 AND L46
 L59 3 SEA L43 AND L47
 L60 1 SEA L44 AND L48

TOTAL FOR ALL FILES

L61 42 SEA L45 AND L49
 L62 12 SEA L42 AND L50
 L63 4 SEA L43 AND L51
 L64 0 SEA L44 AND L52

TOTAL FOR ALL FILES

L65 16 SEA L45 AND L53
 L66 71 SEA L46 AND L50
 L67 25 SEA L47 AND L51
 L68 4 SEA L48 AND L52

TOTAL FOR ALL FILES

L69 100 SEA L49 AND L53
 L70 2 SEA L58 AND L66
 L71 1 SEA L59 AND L67
 L72 0 SEA L60 AND L68

TOTAL FOR ALL FILES

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L74 661285 SEA END OR ENDS OR ENDED OR ENDING# OR ENDCAP? OR TOP OR
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L75 2414569 SEA END OR ENDS OR ENDED OR ENDING# OR ENDCAP? OR TOP OR
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L76 1213049 SEA END OR ENDS OR ENDED OR ENDING# OR ENDCAP? OR TOP OR
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TOTAL FOR ALL FILES

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L78 1051 SEA L3 AND L74

L79 319 SEA L4 AND L75

L80 206 SEA L5 AND L76

TOTAL FOR ALL FILES

L81 1576 SEA L6 AND L77

L82 610 SEA L74 AND L7

L83 191 SEA L75 AND L8

L84 9 SEA L76 AND L9

TOTAL FOR ALL FILES

L85 810 SEA L77 AND L10

L86 3487 SEA L74 AND L16

L87 3320 SEA L75 AND L17

L88 1029 SEA L76 AND L18

TOTAL FOR ALL FILES

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L90 14060 SEA L74 AND L22
L91 28035 SEA L75 AND L23
L92 19563 SEA L76 AND L24

TOTAL FOR ALL FILES

L93 61658 SEA L77 AND L25
L94 7978 SEA L74 AND L26
L95 24546 SEA L75 AND L27
L96 11668 SEA L76 AND L28

TOTAL FOR ALL FILES

L97 44192 SEA L77 AND L29
L98 287 SEA L74 AND L30
L99 261 SEA L75 AND L31
L100 180 SEA L76 AND L32

TOTAL FOR ALL FILES

L101 728 SEA L77 AND L33
L102 42 SEA L82 AND L86
L103 18 SEA L83 AND L87
L104 0 SEA L84 AND L88

TOTAL FOR ALL FILES

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L106 14 SEA L82 AND L90
L107 4 SEA L83 AND L91
L108 0 SEA L84 AND L92

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L110 15 SEA L82 AND L94
L111 9 SEA L83 AND L95
L112 0 SEA L84 AND L96

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L114 24 SEA L82 AND L98
L115 9 SEA L83 AND L99
L116 0 SEA L84 AND L100

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L117 33 SEA L85 AND L101
L118 339 SEA L86 AND L90
L119 347 SEA L87 AND L91
L120 104 SEA L88 AND L92

TOTAL FOR ALL FILES

L121 790 SEA L89 AND L93
L122 195 SEA L86 AND L94
L123 196 SEA L87 AND L95
L124 35 SEA L88 AND L96

TOTAL FOR ALL FILES

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L126 20 SEA L86 AND L98

L127 4 SEA L87 AND L99
L128 0 SEA L88 AND L100
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L131 1324 SEA L91 AND L95
L132 351 SEA L92 AND L96
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L134 19 SEA L90 AND L98
L135 39 SEA L91 AND L99
L136 14 SEA L92 AND L100
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L138 74 SEA L94 AND L98
L139 124 SEA L95 AND L99
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L142 15 SEA L102 AND L114
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L196	1	SEA L120	AND	L124
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TOTAL FOR ALL FILES				
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L203	27	SEA L119	AND	L131

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TOTAL FOR ALL FILES
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TOTAL FOR ALL FILES
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TOTAL FOR ALL FILES
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L221 45 SEA L125 AND L133
L222 0 SEA L122 AND L134
L223 0 SEA L123 AND L135
L224 0 SEA L124 AND L136
TOTAL FOR ALL FILES
L225 0 SEA L125 AND L137
L226 5 SEA L122 AND L138
L227 0 SEA L123 AND L139
L228 0 SEA L124 AND L140
TOTAL FOR ALL FILES
L229 5 SEA L125 AND L141
L230 0 SEA L126 AND L130
L231 0 SEA L127 AND L131
L232 0 SEA L128 AND L132
TOTAL FOR ALL FILES
L233 0 SEA L129 AND L133
L234 0 SEA L126 AND L134
L235 1 SEA L127 AND L135
L236 0 SEA L128 AND L136
TOTAL FOR ALL FILES
L237 1 SEA L129 AND L137
L238 5 SEA L126 AND L138
L239 0 SEA L127 AND L139
L240 0 SEA L128 AND L140
TOTAL FOR ALL FILES
L241 5 SEA L129 AND L141

L242 13 SEA L130 AND L134
L243 17 SEA L131 AND L135
L244 6 SEA L132 AND L136

TOTAL FOR ALL FILES

L245 36 SEA L133 AND L137
L246 13 SEA L130 AND L138
L247 17 SEA L131 AND L139
L248 6 SEA L132 AND L140

TOTAL FOR ALL FILES

L249 36 SEA L133 AND L141
L250 13 SEA L134 AND L138
L251 17 SEA L135 AND L139
L252 6 SEA L136 AND L140

TOTAL FOR ALL FILES

L253 36 SEA L137 AND L141

FILE 'HCA'

L254 41 SEA L70 OR L146 OR L150 OR L166 OR L174 OR L178 OR L182
OR L186 OR L190 OR L214 OR L226 OR L238 OR L250
L255 39 SEA (L54 OR L62 OR L106 OR L110 OR L142 OR L154 OR L178)
NOT L254
L256 19 SEA L38 NOT (L254 OR L255)
L257 30 SEA L34 NOT (L254 OR L255 OR L256)

FILE 'WPIX'

L258 19 SEA L39 OR L59 OR L63 OR L71 OR L107 OR L127 OR L143 OR
L147 OR L151 OR L155 OR L163 OR L171 OR L179 OR L187 OR
L191 OR L199 OR L207 OR L235
L259 10 SEA (L111 OR L115) NOT L258
L260 33 SEA (L35 OR L251) NOT (L258 OR L259)

FILE 'JAPIO'

L261 15 SEA L36 OR L44 OR L60 OR L68 OR L196 OR L204 OR L220 OR
L244 OR L248 OR L252
L262 8 SEA L261 AND L5

FILE 'WPIX'

L263 11 SEA L258 AND L4
L264 0 SEA L259 AND L4
L265 16 SEA L260 AND L4

FILE 'HCA'

L266 3 SEA L254 AND L3
L267 22 SEA L255 AND L3
L268 19 SEA L256 AND L3
L269 30 SEA L257 AND L3

=> file japio

FILE 'JAPIO'

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FILE LAST UPDATED: 7 JAN 2004 <20040107/UP>

FILE COVERS APR 1973 TO SEPTEMBER 30, 2003

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L262 ANSWER 1 OF 8 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 2003-242898 JAPIO

TITLE: MAGNETRON

INVENTOR: AOKURA ISAMU; AIGA MASAYUKI; TSUKADA TOSHIYUKI

PATENT ASSIGNEE(S): MATSUSHITA ELECTRIC IND CO LTD

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2003242898	A	20030829	Heisei	H01J023-04

APPLICATION INFORMATION

STN FORMAT: JP 2002-41077 20020219

ORIGINAL: JP2002041077 Heisei

PRIORITY APPLN. INFO.: JP 2002-41077 20020219

SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2003

AN 2003-242898 JAPIO

AB PROBLEM TO BE SOLVED: To provide a magnetron in which a cathode part need not be heated.

SOLUTION: A cathode substrate 5 is kept at 800 to 900°C, dilution gas of hydrocarbon such as acetylene and methane is

reacted with a **surface** of the cathode substrate 5

by a hot CVD method or a plasma CVD method. An electron emission source with orientation-carbon **nano-tubes** 6

oriented in the direction perpendicular the surface of the cathode substrate 5 with nickel or iron present in the surface of the cathode substrate 5 grown is held by upper and lower end hats 4 to constitute a cathode part 7 of the magnetron.

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IC ICM H01J023-04

L262 ANSWER 2 OF 8 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 2002-352694 JAPIO

TITLE: ELECTRODE, ELECTRON EMISSION ELEMENT AND DEVICE USING IT

INVENTOR: SUGINO TAKASHI; KUSUHARA MASAKI; UMEDA MASARU

PATENT ASSIGNEE(S): WATANABE SHOKO:KK

SUGINO TAKASHI

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2002352694	A	20021206	Heisei	H01J001-304

APPLICATION INFORMATION

STN FORMAT: JP 2001-157826 20010525
ORIGINAL: JP2001157826 Heisei
PRIORITY APPLN. INFO.: JP 2001-157826 20010525
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2002

AN 2002-352694 JAPIO

AB PROBLEM TO BE SOLVED: To manufacture a high-performance electron emission device capable of high-luminance electron emission with a low voltage by further improving electron emission characteristics of a conventional spinto type cold cathode, a carbon **nano-tube** and a carbon **nano-fiber** and thereby to provide it as a key device for a flat-panel display, an imaging device, an electron beam device or a microwave traveling wave tube. SOLUTION: An electron emission device is manufactured by forming a semiconductor film having a thickness of 50 nm or less and an electron affinity of 4.0 eV or less on a **metallic** or **semiconductor substrate** having a spinto type cold cathode, a carbon **nano-tube**, a carbon **nano-fiber** and unevenness. Any of a compound of a group III atom and a nitrogen atom such as aluminum nitride, boron nitride, aluminum boron nitride, aluminum gallium nitride and boron gallium nitride, boron carbon nitride and diamond is used for the semiconductor thin film.

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IC ICM H01J001-304

ICS H01J001-30; H01J011-02; H01J029-04; H01J031-12

L262 ANSWER 3 OF 8 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 2002-285334 JAPIO

TITLE: METHOD FOR GROWING CARBON **NANOTUBE**

INVENTOR: HONMA YOSHIKAZU; KUNIR PURABUHAKARAN; OGINO TOSHIRO

PATENT ASSIGNEE(S): NIPPON TELEGR & TELEPH CORP <NTT>

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2002285334	A	20021003	Heisei	C23C016-26

APPLICATION INFORMATION

STN FORMAT: JP 2001-84315 20010323
 ORIGINAL: JP2001084315 Heisei
 PRIORITY APPLN. INFO.: JP 2001-84315 20010323
 SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined
 Applications, Vol. 2002

AN 2002-285334 JAPIO

AB PROBLEM TO BE SOLVED: To provide a method for growing a carbon **nanotube** on a **silicon substrate**.

SOLUTION: In the method for growing a carbon **nanotube** in which hydrocarbon is **reacted** with the **surface** of a **silicon substrate** in the presence of a catalyst, and a carbon **nanotube** is grown, the above catalyst consists of the oxide of a transition metal. By using the oxide of the transition metal as a catalyst, the carbon **nanotube** can efficiently be grown on to the **silicon substrate**. Thus, the method can be applied to a process where the carbon **nanotube** is formed on the specified position of the **silicon substrate**, and the carbon **nanotube** is bonded with the other silicon element, and can bring a great improvement on the application of the carbon **nanotube** to the element.

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IC ICM C23C016-26

ICS B82B003-00; C01B031-02

L262 ANSWER 4 OF 8 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 2002-179418 JAPIO

TITLE: METHOD FOR FORMING CARBON **NANOTUBE**

INVENTOR: ONO TAKAHITO; ESASHI MASAKI

PATENT ASSIGNEE(S): TOHOKU TECHNO ARCH CO LTD

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2002179418	A	20020626	Heisei	C01B031-02

APPLICATION INFORMATION

STN FORMAT: JP 2000-379334 20001213
 ORIGINAL: JP2000379334 Heisei
 PRIORITY APPLN. INFO.: JP 2000-379334 20001213
 SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined
 Applications, Vol. 2002

AN 2002-179418 JAPIO

AB PROBLEM TO BE SOLVED: To provide a method to grow carbon **nanotubes** on projections on a substrate having projections.

SOLUTION: Projections are formed on a **silicon** or quartz **substrate**, and then a thin film of iron group elements such as nickel, iron and cobalt or compounds of these is deposited as a

catalyst **metal** on the **substrate**. Then carbon **nanotubes** are grown by a hot filament chemical vapor deposition method or microwave plasma vapor phase deposition method by applying a negative voltage on the substrate. The vapor phase deposition method is carried out while heating the substrate. Thus, carbon **nanotubes** can be rather easily and selectively grown on the silicon projections. Or, carbon **nanotubes** can be grown on the top end of a commercially available silicon SPM probe instead of the substrate. By using the probe made of carbon **nanotubes**, the profile of a sample can be accurately observed with high resolution.

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IC ICM C01B031-02
ICS B82B003-00; C23C016-26; C23C016-44; G01N013-16; H01J001-304;
H01J009-02

L262 ANSWER 5 OF 8 JAPIO (C) 2004 JPO on STN
ACCESSION NUMBER: 2002-115070 JAPIO
TITLE: METHOD FOR DEPOSITING GRAPHITE **NANOFIBER**
THIN FILM BY THERMAL CVD METHOD
INVENTOR: HIRAKAWA MASAOKI; MURAKAMI HIROHIKO
PATENT ASSIGNEE(S): ULVAC JAPAN LTD
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2002115070	A	20020419	Heisei	C23C016-46

APPLICATION INFORMATION

STN FORMAT: JP 2000-307961 20001006
ORIGINAL: JP2000307961 Heisei
PRIORITY APPLN. INFO.: JP 2000-307961 20001006
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined
Applications, Vol. 2002

AN 2002-115070 JAPIO

AB PROBLEM TO BE SOLVED: To improve adhesion between a metallic thin film as an undercoat layer and a substrate in depositing a graphite **nanofiber** thin film used for a carbon electron emission source.

SOLUTION: A thin film of non-catalytic metal is deposited on a glass **substrate** or Si **substrate** into a prescribed pattern, and then a thin film of catalytic metal composed of Fe, Co or alloy containing at least either of these metals is deposited into a prescribed pattern on the above pattern of non-catalytic **metal**. This **substrate** is placed in an evacuated vacuum chamber and heated. Then carbon-containing gas and gaseous hydrogen are introduced into the vacuum chamber and pressure inside the chamber is held at about 1 atm to grow graphite

nanofibers in the pattern part alone on the substrate by a thermal CVD method. Moreover, before exerting the thermal CVD method, the substrate is heat treated under vacuum.

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IC ICM C23C016-46

ICS B82B003-00; C01B031-02; C23C016-26; D01F009-133; H01J009-02

L262 ANSWER 6 OF 8 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 2002-115059 JAPIO

TITLE: METHOD FOR CONTROLLING DIAMETER OF GRAPHITE
NANOFIBER

INVENTOR: HIRAKAWA MASAOKI; MURAKAMI HIROHIKO

PATENT ASSIGNEE(S): ULVAC JAPAN LTD

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2002115059	A	20020419	Heisei	C23C016-26

APPLICATION INFORMATION

STN FORMAT: JP 2000-307963 20001006

ORIGINAL: JP2000307963 Heisei

PRIORITY APPLN. INFO.: JP 2000-307963 20001006

SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2002

AN 2002-115059 JAPIO

AB PROBLEM TO BE SOLVED: To provide a method for controlling the diameter of a graphite **nanofiber** which can be used as a carbon based electron emission source.
SOLUTION: A substrate obtained by forming a catalytic metallic thin film of Fe, Co or an alloy containing at least one kind of those **metals** on the **surface** of a glass **substrate** or an **Si substrate** so as to have a thickness of 10 to 50 nm in prescribed patterns or the substrate to be treated which has a noncatalytic metallic thin film formed under the catalytic metallic thin film in prescribed patterns is subjected to heat treatment in a vacuum, thereafter, a carbon- containing gas or gaseous hydrogen are introduced into the vacuum chamber from a position lower than the position where the substrate is placed, the pressure in the chamber is kept to almost one atmospheric pressure, and graphite **nanofiber** is grown only on the pattern parts on the substrate by a thermal CVD process.

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IC ICM C23C016-26

ICS B82B003-00; C01B031-02; D01F009-127

L262 ANSWER 7 OF 8 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 2001-030200 JAPIO

TITLE: FILM AND MANUFACTURE OF LAMINATE USING THE FILM
 INVENTOR: NIHEI FUMIYUKI
 PATENT ASSIGNEE(S): NEC CORP
 PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2001030200	A	20010206	Heisei	B82B003-00

APPLICATION INFORMATION

STN FORMAT: JP 1999-207874 19990722
 ORIGINAL: JP11207874 Heisei
 PRIORITY APPLN. INFO.: JP 1999-207874 19990722
 SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2001

AN 2001-030200 JAPIO

AB PROBLEM TO BE SOLVED: To cover a base plate having a large area surface and a base plate having a non-flat surface with a **nanotube** in a film-form manner, uniformly, and at a low-cost.

SOLUTION: A film containing a carbon **nanotube** is formed of **silicon**. A **base** plate having a surface layer formed of Pt/Ti is coated with paint, containing a carbon **nanotube**, through a stainless mask by spray coating to form a film. It is preferable that the **end** part of the **nanotube** is exposed in a state to be opened to the surface of the film. Further, by accumulating a metal on the formed film, electrical characteristics are preferably improved.

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IC ICM B82B003-00

ICS B05D007-24; B32B015-01; B32B015-08; C01B031-02; C08J005-18; C08K003-04; C08L101-00

L262 ANSWER 8 OF 8 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 2000-321292 JAPIO

TITLE: **NANO-TUBE, NANO-TUBE PROBE, AND THEIR MANUFACTURE**

INVENTOR: NAKAYAMA YOSHIKAZU; AKITA SEIJI; HARADA AKIO

PATENT ASSIGNEE(S): NAKAYAMA YOSHIKAZU

DAIKEN KAGAKU KOGYO KK

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2000321292	A	20001124	Heisei	G01N037-00

APPLICATION INFORMATION

STN FORMAT: JP 1999-173106 19990516

ORIGINAL: JP11173106 Heisei
PRIORITY APPLN. INFO.: JP 1999-173106 19990516
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined
Applications, Vol. 2000

AN 2000-321292 JAPIO

AB PROBLEM TO BE SOLVED: To obtain **nano-tube** probes having the same physical structure at their front end sections by providing sensor sections for ultrafine particles, fullerene, etc., at the front **ends** of **nano-tubes**.
SOLUTION: A Ni metal film 4 having a thickness of about 10 nm is formed on the **surface** of a **silicon substrate** 2 carrying an iron oxide on its surface by vapor deposition and the degree of vacuum in a cylindrical container having a diameter of about 28 mm and a length of about 50 cm is maintained at about 60 Torr by making an He gas to flow in the container at a flow rate of about 50 sccm. When the metallic film 4 is heat-treated for bout one hour by heating the temperature of the film 4 to about 800°C at a temperature-rise rate of about 120°C/min, the film 4 converts to many ultrafine Ni particles 6 having diameters of about 20 nm. When a C6H6 gas is allowed to flow in the container at a flow rate of about 10 sccm for about one hour by maintaining the degree of vacuum at about 60 Torr thereafter, carbon atoms accumulate in the lower ends of the particles 6 due to the dehydration catalytic reaction of the particles 6 and **nano-tubes** 8 are formed. The **nano-tubes** 8 grow by pushing up the particles 6 and form carbon **nano-tubes** 10 having ultrafine particles.

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IC ICM G01N037-00

ICS G01B021-30; G11B005-127; G12B001-00

=> file wpix

FILE 'WPIX'

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FILE LAST UPDATED: 15 JAN 2004 <20040115/UP>
MOST RECENT DERWENT UPDATE: 200404 <200404/DW>
DERWENT WORLD PATENTS INDEX SUBSCRIBER FILE, COVERS 1963 TO DATE

=> d 1263 1-11 max

L263 ANSWER 1 OF 11 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2004-038530 [04] WPIX

DNN N2004-031344 DNC C2004-015594

TI Hydrogen storage/feed system for fuel cell system, has vacuum pump for forced evacuation of hydrogen generated in catalyst reactor, and

to discharge through vapor liquid separator.

DC E36 L03 Q69 X16

PA (DENS-N) DENSEI KK; (ICHI-I) ICHIKAWA K; (SEKI) SEKISUI CHEM IND CO LTD

CYC 1

PI JP 2003306301 A 20031028 (200404)* 11p C01B003-00

ADT JP 2003306301 A JP 2002-107806 20020410

PRAI JP 2002-107806 20020410

IC ICM C01B003-00

ICS C01B003-26; F17C011-00; H01M008-04

AB JP2003306301 A UPAB: 20040115

NOVELTY - A compressor (31) pressure feeds hydrogen containing raw material from storage tank (2), to spray on catalyst (41) heated by heater (43) in reactor (4). The hydrogen containing raw material is dehydrogenated by catalyst reactors. A vacuum pump (12) is connected to evacuate hydrogen generated in reactor (4) and to discharge through vapor liquid separator (5).

DETAILED DESCRIPTION - The reaction material recovery tank (8) is provided to recover reaction material from the vapor liquid separator. The catalyst is supported in metallic carrier and hydrogen containing raw material is sprayed as a mist over the catalyst. A honeycomb structured sheet like **reactivated** carbon **base** supports the **metallic** carrier.

Hydrogen containing raw material is sprayed intermittently after fixed time reaction by feed mechanism controller. The catalyst packed in the form of fine granules in layers in cylindrical container forming the electromagnetic reactor. The heater is nichrome wire heater or induction coil heater.

USE - For fuel cell systems.

ADVANTAGE - Reversible equilibrium reaction is removed by forced evacuation of generated hydrogen and improves overall efficiency hence ensures stable hydrogen supply.

DESCRIPTION OF DRAWING(S) - The figure shows a block diagram of hydrogen storage/supply system.

hydrogen storage tank 2
reactor 4
vapor liquid separator 5
reaction material recovery tank 8
vacuum pump 12
compressor 31
catalyst 41
heater 43
Dwg.1/2

TECH JP 2003306301 AUPTX: 20040115

TECHNOLOGY FOCUS - METALLURGY - The metallic catalyst carrier is made of metal chosen from nickel, palladium, ruthenium, osmium, chromium, cobalt, tungsten, vanadium or iron.

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - The carrier base is chosen from activated carbon, carbon **nano tube**, molecular sieve, zeolite, silica gel or alumina.

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - The hydrogen containing raw material is an aromatic compound is selected from benzene, toluene, xylene, mesitylene, naphthalene, methyl naphthalene, anthracene phenyl, phenanthrene or its alkyl derivatives. The alkyl derivative is a compound chosen from cyclohexane, methyl cyclohexane, 1-2, methyl cyclohexane 1,3 dimethyl cyclohexane decahydro naphthalene (decalin).

L263 ANSWER 2 OF 11 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2003-812394 [76] WPIX

CR 2003-812378 [76]

DNN N2003-650548 DNC C2003-225816

TI Porous composition useful in making monolith used as membrane or chromatographic for support for bio-molecular or molecular separations, comprises carbonaceous material and/or inorganic oxide with aggregates, and discrete linkers.

DC A18 A28 A89 B04 D16 J01 S03

IN ADAMS, C E; GU, F; KYRLIDIS, A; RUMPF, F H

PA (CABO) CABOT CORP

CYC 101

PI WO 2003072640 A2 20030904 (200376)* EN 47p C08J000-00

RW: AT BE BG CH CY CZ DE DK EA EE ES FI FR GB GH GM GR HU IE IT
KE LS LU MC MW MZ NL OA PT SD SE SI SK SL SZ TR TZ UG ZM ZW

W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ
DE DK DM DZ EC EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP
KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ
NO NZ OM PH PL PT RO RU SC SD SE SG SK SL TJ TM TN TR TT TZ
UA UG UZ VC VN YU ZA ZM ZW

ADT WO 2003072640 A2 WO 2003-US5848 20030225

PRAI US 2002-359550P 20020225; US 2002-359502P 20020225

IC ICM C08J000-00

AB WO2003072640 A UPAB: 20031125

NOVELTY - A porous composition (C1) comprises carbonaceous material and/or inorganic oxide, and discrete linkers. The carbonaceous material and/or inorganic oxide comprise aggregates containing particles. The linkers connect the aggregates.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for:

(1) making the composition comprising providing carbonaceous material and/or inorganic oxide, combining discrete linkers with aggregates, and forming a continuous network containing the aggregates;

(2) a composition (C2) comprising a porous monolith comprising

a carbonaceous material and/or an inorganic oxide; and at least one organic compound attached to the surface of the monolith;

- (3) a monolith comprising (C1);
- (4) a membrane comprising (C1) or (C2);
- (5) a chromatographic support comprising (C1); and
- (6) a chromatography column comprising (C2).

USE - The composition is used in making monolith used as membrane, or chromatographic for support for bio-molecular or molecular separations. It can also be used for high surface area packing for chemical **reactors**, and support for **heterogeneous** catalysis.

ADVANTAGE - The composition provides robust support materials that can be derivatized (claimed). It can maximize convective material transport and minimize diffusional transport limitations.
Dwg.0/0

TECH WO 2003072640 A2UPTX: 20031125

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Components: (C1) comprises continuous network of the aggregates. The discrete linker(s) is adhered or covalently bonded to at least two of the aggregates. The discrete linker(s) acts as an adhesive to connect the aggregates. Each aggregate has pores defined by the particle surface. The composition comprises flow channels. The particles comprise ceramics, carbonaceous materials, metals or polymers. The ceramics are nitrides, carbides, selenides, arsenides, borides or preferably oxides or metals. The oxides are silica, alumina, ceria, titania, zirconia, boria, chromia, alumino-silicates, tin oxide, or nickel oxide (preferably silica, alumina, ceria, titania, or zirconia). The metals are gold, silver, platinum, iron, nickel, or palladium. The particles comprises carbonaceous, e.g. (fumed) carbon black, **nanotubes**, (buckminster)fullerenes, vitreous carbon, or carbon allotropes. The linkers are (in)organic molecules, or (bio)polymers. The discrete linkers are cross-linked capable of cross-linking with each other. The linkers, surface of the composition, and aggregates are derivatized. At least one property of the linker is responsive to the environmental condition(s). The environmental condition(s) is pH, electric field, magnetic field, temperature, solvent, ionic strength, rheology, shear or light. The continuous network comprising the aggregates is dispersed in liquid medium. The particles are lyophobic.

Preferred Properties: (C1) has a void volume of 45-95% relative to the total volume of the composition. The first fraction of flow channels has mean diameter of 5-20 nm. The second fraction of flow channels has mean diameter of 25 nm -10 micro m. The third fraction of flow channels has mean diameter of 500 nm-50 micro m, preferably 1-20 micro m. The composition has a surface area of 10-300 m²/ml of composition. The pores have mean diameter of 5-200 nm or 25 nm -10 micro m, preferably 25 nm-1 micro m. The polymer particles have transition temperature of at least 100 degrees C. The physical

property is pore size, binding strength, binding capability, flexibility, or linker conformation.

Preferred Methods: The method also comprises treating the lyophilic particles to render them lyophobic by modifying the surface of the particles.

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Components: The linkers are (in)organic molecules, or (bio)polymers. The organic molecules are electrophiles, nucleophiles, molecules that participate in cyclo-addition or electro-cyclic bond forming reactions, or molecules forming non-covalent interactions. In (C2) the organic compound is preferably phenyl and naphthyl groups with ionic or ionizable groups, fluorinated groups, aromatic compound of formulae $\text{Ar}-(\text{CnH}_{2n+1})_x$ groups, $\text{Ar}-\text{C}((\text{CnH}_{2n})\text{SO}_2\text{CH}=\text{CH}_2)_m$, $\text{Ar}-\text{C}(\text{CH}_3)_3$, $\text{Ar}-((\text{CnH}_{2n})\text{CN})_m$, $\text{Ar}-((\text{CnH}_{2n})\text{C}(\text{O})\text{N}(\text{H})-\text{CxH}_{2x+1})_m$, $\text{Ar}-((\text{CnH}_{2n})\text{N}(\text{H})\text{C}(\text{O})-\text{CxH}_{2x+1})_m$, $\text{Ar}-((\text{CnH}_{2n})\text{O}-\text{C}(\text{O})-\text{N}(\text{H})-\text{CxH}_{2x+1})_m$, $\text{Ar}-((\text{CnH}_{2n})\text{C}(\text{O})\text{N}(\text{H})-\text{R})_m$, $\text{Ar}-((\text{CnH}_{2n})\text{N}(\text{H})-\text{C}(\text{O})-\text{R})_m$, $\text{Ar}-((\text{CnH}_{2n})\text{O}-\text{C}(\text{O})\text{N}(\text{H})-\text{R})_m$, $\text{Ar}-(\text{CH}_2)_m(\text{O}(\text{CH}_2)_y)_n\text{NR}_2$, $\text{Ar}-(\text{CH}_2)_m(\text{O}(\text{CH}_2)_y)_n\text{N}+\text{R}_3$, $\text{Ar}-\text{C}(\text{O})(\text{O}(\text{CH}_2)_y)_n\text{NR}_2$, $\text{Ar}-(\text{CH}_2)_m(\text{O}(\text{O}(\text{CH}_2)_y)_n\text{N}+\text{R}_3$, $\text{Ar}-\text{C}(\text{O})\text{NH}(\text{CH}_2)_m(\text{O}(\text{CH}_2)_y)_n\text{NR}_2$, $\text{Ar}-\text{C}(\text{O})\text{NH}(\text{CH}_2)_m(\text{O}(\text{CH}_2)_y)_n\text{N}+\text{R}_3$, $\text{Ar}-\text{C}(\text{O})\text{NH}(\text{CH}_2)_m(\text{O}(\text{CH}_2)_y)_n\text{NR}_2$, $\text{Ar}-(\text{CnH}_{2n})\text{COOX})_m$, $\text{Ar}-(\text{CnH}_{2n})\text{OH})_m$, $\text{Ar}-(\text{CnH}_{2n})\text{NR}_2)_m$, $\text{Ar}-(\text{CnH}_{2n})\text{NR}_3\text{X})_m$, $\text{Ar}-(\text{CnH}_{2n})\text{CHNR}_3+\text{COO}-)_m$, $\text{Ar}-(\text{CnH}_{2n})\text{CH}=\text{CH}_2)_m$, chiral ligands, (derivatized) optically active amino acid, or cyclodextrin attached through $-\text{Ar}(\text{CH}_2)_n$.

Ar = aromatic group;

n = 0-30;

m = 1-3;

R = H, alkyls, preferably COOH, SO₃H;

X = H, cations, anion, organic groups;

x = 0-20; and

y = 0 or integer.

TECHNOLOGY FOCUS - POLYMERS - Preferred Components: The linkers are (in)organic molecules, or (bio)polymers. The polymers are polyorganosiloxanes, alkyds, epoxies, polyamides, polyesters, polyethers, polyimides, polyolefins, polyols, polysulfides, polyvinyl acetate, polyurethanes, polycarbonates, poly(meth)acrylates, polystyrenes, or polyamines. The biopolymers are proteins, nucleic acids, or polypeptides.

L263 ANSWER 3 OF 11 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2003-787972 [74] WPIX

DNN N2003-631489 DNC C2003-217410

TI Carbon **nanotube** material useful in manufacturing composite material, electronic applications, mechanical applications, comprises microparticulate carbide or oxide material.

DC A60 E36 L02 L03 P73 U11 U12

IN LAO, J Y; LI, W; REN, Z; WEN, J G

PA (BOST-N) BOSTON COLLEGE

CYC 102

PI WO 2003060209 A1 20030724 (200374)* EN 45p D01F009-12

RW: AT BE BG CH CY CZ DE DK EA EE ES FI FR GB GH GM GR HU IE IT

KE LS LU MC MW MZ NL OA PT SD SE SI SK SL SZ TR TZ UG ZM ZW

W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ

DE DK DM DZ EC EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP

KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ

NO NZ OM PH PL PT RO RU SC SD SE SG SK SL TJ TM TN TR TT TZ

UA UG UZ VC VN YU ZA ZM ZW

US 2003157333 A1 20030821 (200374) B32B009-00

ADT WO 2003060209 A1 WO 2003-US727 20030110; US 2003157333 A1
Provisional US 2002-347808P 20020111, US 2003-339849 20030110

PRAI US 2002-347808P 20020111; US 2003-339849 20030110

IC ICM B32B009-00; D01F009-12

AB WO2003060209 A UPAB: 20031117

NOVELTY - A carbon **nanotube** material comprises a microparticulate carbide or oxide material. The microparticulate carbide or oxide material exists on the surface of the carbon **nanotube** material.

DETAILED DESCRIPTION - An INDEPENDENT CLAIM is included for manufacturing carbon **nanotube** material containing microparticulate carbide material.

USE - Useful in manufacturing composite material (claimed). It is also used in manufacturing high-strength, light-weight mechanical and electrical device components, e.g. electrodes, batteries, energy storage cells, sensors, capacitors, light-emitting diodes, and electrochromic displays. It is also useful in other applications, e.g. hydrogen storage devices, electrochemical capacitors, fuel cells, and semiconductors.

ADVANTAGE - The invention has superior mechanical properties, enabling the production of high-strength composites. It can be produce in a large scale and cost efficient synthetic processes. It provides greater carbon **nanotube** surface area resulting in stronger adhesions of matrix material.

DESCRIPTION OF DRAWING(S) - Schematic drawing of carbon **nanotube** (CNT) morphologies.

Dwg.5/14

TECH WO 2003060209 A1UPTX: 20031117

TECHNOLOGY FOCUS - ELECTRONICS - Preferred Components: The microparticulate carbide or oxide material exists as carbide or oxide nanolumps, or carbide nanoparticles on the surface of the carbon **nanotube** material. The carbide or oxide nanolumps have an average diameter of 10-200, preferably 80 nanometers. The carbide or oxide nanolumps residue is proximal to one another and remains bound to the surface of the carbon **nanotube** material by physical or chemical bonding. The carbide or oxide

nanolumps has an inter-particle spacing of 30-500, preferably 50-100 nanometers. The microparticulate carbide material is (non)-metallic carbide. The microparticulate carbide material is silicon carbide, magnesium carbide, titanium carbide, niobium carbide, or preferably boron carbide of formula B_xC_y .

$x = 4-50$; and

$y = 1-4$.

The boron carbide is preferably of formula B_4C (preferred), $B_{10}C$, $B_{13}C$, $B_{12}C_3$, $B_{50}C_2$, $B_{50}C$, $B_{48}C_3$, $B_{51}C$, $B_{49}C_3$, B_8C , $B_{12}C$, $B_{12}C_2$, or $B_{11}C_4$. The oxide material is a (non)-metallic. The oxide material is magnesium oxide (MgO), or boron oxide (B_2O_3). The carbon **nanotube** material is a multi-walled carbon **nanotube** morphology. The microparticulate carbide material is present as a stable single phase in a homogeneity of 8-20 atom% carbon. The carbon **nanotubes** material has bone-shaped or knotted rope-shaped morphology. The carbide forming source material is a boron source powder. The pressure atmosphere is reduced at less than 0.5 torr. The boron source is aluminum dibromide, calcium dibromide, gallium dibromide, or preferably magnesium dibromide. The mineral acid is hydrofluoric acid, hydrochloric acid, hydrobromic acid, hydroiodic acid, sulfuric acid, or nitric acid. The mineral acid is preferably nitric acid or hydrochloric acid. The metallic material is tantalum foil. The heating chamber is at 500-2000, preferably 1100-1150degreesC.

Preferred Method: The method comprises a **solid state reaction** between boron source and carbon **nanotubes**.

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preparation: Manufacture of carbon **nanotube** material containing microparticulate carbide material comprises contacting carbon **nanotubes** with a mineral acid, mixing the acid-treated carbon **nanotubes** with a carbide forming source material to form a mixture, enclosing the mixture of carbon **nanotubes** and carbide forming source material with a metallic material, placing the metal material with the mixture of carbon **nanotubes** and carbide forming source material in a heating chamber, subjecting the heating chamber to a reduced pressure atmosphere, and maintaining the heating chamber at an elevated temperature to cause formation of the microparticulate carbide material on the surface of the carbon **nanotube** material.

L263 ANSWER 4 OF 11 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2003-677770 [64] WPIX

DNN N2003-541058 DNC C2003-184980

TI Manufacture of carbon **nanotube** device, used in electron emitter, by growing graphitic layer on **nanotube** core by changing reaction parameters to promote the distinct formation of

carbon material.

DC E36 L03 P73 U11 U12 V05

IN CHOW, L; KLECKLEY, S; ZHOU, D

PA (UYFL-N) UNIV CENT FLORIDA

CYC 1

PI US 6582673 B1 20030624 (200364)* 13p C01B031-04

ADT US 6582673 B1 US 2000-528259 20000317

PRAI US 2000-528259 20000317

IC ICM C01B031-04

ICS B32B005-16

AB US 6582673 B UPAB: 20031006

NOVELTY - A carbon **nanotube** device is manufactured by growing an integrally attached graphitic layer on a carbon **nanotube** core by changing the reaction parameters to promote the distinct formation of carbon material consisting of amorphous carbon and/or graphitic carbon.

DETAILED DESCRIPTION - Manufacture of carbon **nanotube** device (11) involves:

- (a) preparing a transition metal catalyst on a substrate;
- (b) placing the catalyst and **substrate** in a **reaction** vessel;
- (c) purging the reaction vessel by heating it to 500-750 deg. C while introducing a gaseous mixture of hydrogen and an inert gas;
- (d) growing a carbon **nanotube** core by changing the gaseous mixture to a stream consisting of approx. 10% carbon-containing gas and approx. 90% inert gas, while increasing the temperature of the vessel to 750-90 deg. C;
- (e) growing an integrally attached graphitic outer layer (12) on the core by changing the reaction parameters to promote the distinct formation of carbon material consisting of amorphous carbon (12A) and/or graphitic carbon (12B);
- (f) removing the carbon **nanotube** with graphitic outer layer from the reaction vessel; and
- (g) breaking away portion of the graphitic layer to partially expose the core.

USE - Production of **nanotube** device for scanning probe microscope, electron microscope or electron emitter for flat panel displays.

ADVANTAGE - The graphitic layer improves the ability to handle and manipulate the **nanotube** device in different applications, such as a probe tip for scanning probe microscopes and optical microscopes, or as an electron emitting device.

DESCRIPTION OF DRAWING(S) - The figure is a diagram of the carbon **nanotube** with graphitic outer layer.

Carbon **nanotube** device 11

Graphitic outer layer 12

Amorphous carbon 12A

Graphitic carbon 12B

Dwg.1/6

TECH US 6582673 B1 UPTX: 20031006

TECHNOLOGY FOCUS - CHEMICAL ENGINEERING - Preferred Method: The reaction parameters are changed by:

(i) introducing to the reaction vessel a gaseous mixture consisting of approximately 5% hydrogen gas and approximately 90% inert gas while increasing the temperature of the vessel to 900-1000degreesC to promote the growth of an amorphous carbon material;

(ii) maintaining the conditions of approximately 30 minutes to approximately 1 hour; and

(iii) annealing the reaction product by introducing a gaseous mixture consisting of approximately 10% carbon-containing gas and approximately 90% inert gas while maintaining the temperature of the vessel at approximately 100degreesC to promote the growth of graphitic carbon coating.

Preferred Conditions: The graphitic outer layer forms on the carbon **nanotube** core at 900-1000, preferably approximately 1000degreesC. The purging step occurs when the vessel is heated at approximately 725degreesC. The **nanotube** core grows when the vessel is heated to approximately 750-900degreesC.

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Components: The transition metal catalyst includes cobalt, nickel, iron and/or their mixtures or alloys, preferably on a **silicon substrate**. The catalyst is a mixture of 50% iron and 50% nickel. The inert gas includes helium, nitrogen or (preferably) argon.

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Gas: The carbon-containing gas includes methane (especially), ethane, propane, butane, ethylene, cyclohexane, carbon monoxide or carbon dioxide.

L263 ANSWER 5 OF 11 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2002-491521 [53] WPIX

DNC C2002-139639

TI Production of high activity heterogeneous catalyst for wide range of reactions involves contacting fluid containing metal catalytic compound (or precursor) with carbon **nanotube**.

DC J04

IN UNGER, E

PA (INFN) INFINEON TECHNOLOGIES AG

CYC 1

PI DE 10048406 A1 20020606 (200253)* 5p B01J037-16

ADT DE 10048406 A1 DE 2000-10048406 20000929

PRAI DE 2000-10048406 20000929

IC ICM B01J037-16

ICS B01J037-18

AB DE 10048406 A UPAB: 20020820

NOVELTY - Production of a heterogeneous catalyst comprises:

(i) contacting the inside of a carbon **nanotube** with a fluid containing a metal catalytic compound (or precursor); and
(ii) separating the **nanotube** from the fluid and treating it under reductive conditions such that the carbon structure is etched away in places.

USE - Used for hydrogenation, carbonyl uptake, hydroformylation, reductive or oxidative carbonylation, decarbonylation, transfer hydrogenation, hydrosilylation, hydrocyanation or oligomerization (claimed).

ADVANTAGE - The catalyst has high activity and, being solid, is easily removed from reaction products.

Dwg.0/0

TECH DE 10048406 A1 UPTX: 20020820

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Process The precursor is converted to the active form under the reductive conditions in stage (ii), such conditions involving use of a plasma in a H₂ atmosphere. The fluid is a solution, gas or melt, and contains the catalyst or precursor at at least 10-2 mmol/l and also H₂SO₄ and/or HNO₃, especially at at least 2 mmol/l.

Preferred Catalyst The catalytic compound is an oxide, salt or organometallic compound of Pd, Pt, Rh, Ru, Zn, Ag, V, Fe, Sn, Mo, Cr, Cu or Ni. 29 oxides are specified, including PtO₂, RuO₄, ZnO, VOCl₃, Fe₃O₄ and NiO; 96 salts are specified, including NiSO₄.NH₄SO₄, Pd(NO₃)₂, RuCl₃, CuCl₂, ZnF₂, FePO₄, Cr(OH)SO₄ and MoS₂; and 7 organometallic compounds are specified, including Rh₆(CO)₁₆, RhCl(P(C₆H₅)₃)₃ and Fe₂(CO)₉.

ABEX DE 10048406 A1 UPTX: 20020820

EXAMPLE - An active catalyst on a support was obtained by dipping a film of carbon nanotubes in an AgNO₃ melt for at least 10 minutes at 22-230 degrees C, within seconds spraying both sides of the film with deionized water at 4 degrees C, drying the film in air, introducing it in a H₂ atmosphere diluted with 1% argon or helium into a plasma reactor and setting up a plasma at 13.7 MHz for 20 minutes, followed by removing the gas mixture.

FS CPI

FA AB

MC CPI: J04-E04; J04-E04B; N06-E01

DRN 1508-S; 1520-S; 1547-S; 1925-S; 1952-S; 2070-S

L263 ANSWER 6 OF 11 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2002-154381 [20] WPIX

DNN N2002-117462 DNC C2002-048110

TI Manufacture of component part by dissociating carbon atoms from carbon **based** material in **reaction** area, isolating reaction area where carbon **nanotubes** nucleate,

and dynamically locating injecting, dissociating and isolating steps.

DC E36 L02 L03 V05

IN HERMAN, F J

PA (LOCK) LOCKHEED MARTIN CORP; (HERM-I) HERMAN F J

CYC 96

PI WO 2001077015 A2 20011018 (200220)* EN 25p C01B031-02

RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC
MW MZ NL OA PT SD SE SL SZ TR TZ UG ZW

W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ
DE DK DM DZ EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE
KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO
NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG UZ VN
YU ZA ZW

AU 2001053355 A 20011023 (200220) C01B031-02

US 2002018745 A1 20020214 (200220) D01F009-12

US 6495116 B1 20021217 (200307) D01F009-12

EP 1272426 A2 20030108 (200311) EN C01B031-02

R: AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK
NL PT RO SE SI TR

KR 2003011822 A 20030211 (200339) B82B003-00

JP 2003530235 W 20031014 (200368) 21p B82B003-00

ADT WO 2001077015 A2 WO 2001-US11777 20010410; AU 2001053355 A AU

2001-53355 20010410; US 2002018745 A1 Div ex US 2000-546081

20000410, US 2001-967674 20010927; US 6495116 B1 US 2000-546081

20000410; EP 1272426 A2 EP 2001-926845 20010410, WO 2001-US11777

20010410; KR 2003011822 A KR 2002-713549 20021009; JP 2003530235 W

JP 2001-575498 20010410, WO 2001-US11777 20010410

FDT AU 2001053355 A Based on WO 2001077015; EP 1272426 A2 Based on WO

2001077015; JP 2003530235 W Based on WO 2001077015

PRAI US 2000-546081 20000410; US 2001-967674 20010927

IC ICM B82B003-00; C01B031-02; D01F009-12

AB WO 200177015 A UPAB: 20020402

NOVELTY - A component part is made using carbon **nanotubes** by injecting carbon based material into a reaction area; dissociating carbon atoms from the carbon based material; isolating the reaction area at a predetermined temperature and pressure, where the carbon **nanotubes** nucleate; and dynamically locating the injecting, dissociating and isolating steps to nucleate the carbon **nanotubes**.

DETAILED DESCRIPTION - Manufacture of a component part having a predetermined configuration using carbon **nanotubes** comprises:

(a) injecting carbon based material into a reaction area at a predetermined rate;

(b) dissociating carbon atoms from the carbon based material at a predetermined rate;

(c) isolating the reaction area at a predetermined temperature

and a predetermined pressure, where the carbon **nanotubes** nucleate in the reaction area; and

(d) dynamically locating the injecting, dissociating and isolating steps to nucleate the carbon **nanotubes** in the predetermined configuration.

An INDEPENDENT CLAIM is also included for a system for manufacturing a component having a predetermined configuration using carbon **nanotubes** comprising:

(a) carbon injection unit for injecting a carbon based material into a reaction area;

(b) carbon dissociation unit for dissociating carbon from the carbon based material;

(c) isolation unit for controlling the pressure and temperature of the reaction area, where the carbon **nanotubes** nucleate; and

(d) control unit in communication with and capable of dynamically locating the carbon injection unit, carbon dissociation unit and isolation unit in a predetermined pattern to nucleate the carbon **nanotubes** in the predetermined configuration.

USE - For manufacturing a component part having a predetermined configuration using carbon **nanotubes**.

ADVANTAGE - The inventive method economically produces a component part having a predetermined configuration using **nanotubes** utilizing stronger structural materials.

DESCRIPTION OF DRAWING(S) - The figure illustrates an architecture of the system.

Dwg.2/3

TECH WO 200177015 A2UPTX: 20020402

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Material: The carbon based material further includes **metal based** material(s).

TECHNOLOGY FOCUS - ELECTRONICS - Preferred Method: The method further comprises:

(1) decomposing the predetermined configuration into multiple cross-sectional layers;

(2) repeating the step of dynamically locating the injecting, dissociating and isolating steps for each multiple cross-sectional layer, where each successive cross-sectional layer is stacked on a previous cross-sectional layer;

(3) injecting a carbon based material having a first **metal based** material;

(4) injecting a second carbon based material having a second **metal based** material;

(5) dynamically varying a rate of injection of the carbon based material;

(6) dynamically varying a rate of dissociation from the carbon based material; dynamically varying the predetermined pressure and temperature;

- (7) dynamically varying a concentration of the **metal based** material in the carbon based material; and
 (8) adjusting a growth direction of the carbon **nanotube** during a growth period.

TECHNOLOGY FOCUS - MECHANICAL ENGINEERING - Preferred System: The system further includes a substrate capable of providing an initial nucleation surface for the carbon **nanotubes**.

Preferred Function: The control unit dynamically varies carbon based material injection rate; the dissociation rate; the pressure and temperature of the reaction area; and dynamically varies an amount and type of **metal based** material within the carbon based material.

Preferred Components: The carbon dissociation unit comprises a laser, an electron beam, and an electrical arc discharge unit. The substrate comprises seed material arranged in a predetermined pattern consistent with a first cross-sectional layer of the multiple cross-sectional layers.

KW [1] 184601-0-0-0 CL PRD USE; 7659-0-0-0 CL PRD USE; 2211-0-0-0 CL;
 7382-0-0-0 CL
 FS CPI EPI
 FA AB; GI; DCN
 MC CPI: E05-U02; L02-H04; L03-H
 EPI: V05-L01A3A; V05-L05B5
 DRN 0323-S; 0323-U; 1669-S; 1669-U
 CMC UPB 20020402
 M3 *01* G000 G830 M280 M320 M415 M424 M510 M520 M530 M541 M720 M740
 M781 M905 N120 N142 N173 N209 N212 N304 N309 N311 N515 N520
 N521 N522 N523 N524 Q453 Q454 R032 R036 R038
 RIN: 90002
 DCN: RA03UZ-K; RA03UZ-P; RA03UZ-U
 M3 *02* G000 G830 M280 M320 M415 M424 M510 M520 M530 M541 M720 M740
 M781 M905 N120 N142 N173 N209 N212 N304 N309 N311 N515 N520
 N521 N522 N523 N524 Q453 Q454 R032 R036 R038
 RIN: 90000 90000
 DCN: R23754-K; R23754-P; R23754-U; RA03I9-K; RA03I9-P;
 RA03I9-U
 M3 *03* C106 C810 M411 M730 M904 M905 M910
 DCN: R01669-K; R01669-S; R05085-K; R05085-S
 M3 *04* M210 M211 M320 M416 M610 M620 M730 M904 M905 M910
 DCN: R00323-K; R00323-S

L263 ANSWER 7 OF 11 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2002-114492 [15] WPIX

DNN N2002-085321 DNC C2002-035224

TI Zeolite-substrate composite comprising zeolite monolayer or multilayer bound on substrate surface for, e.g. separation of gas or liquid, comprises substrate, molecular sieve particles, and linker.

DC E19 H04 J01 J04 P73
 IN CHOI, S Y; HA, G; JUN, Y S; LEE, G S; LEE, Y J; OH, G S; PARK, Y S;
 YOON, G B; HAH, G; JEON, Y S; CHOI, S; CHUN, Y; HA, K; LEE, G; LEE,
 Y; OH, K; PARK, Y; YOON, K B
 PA (UYSO-N) UNIV SOGANG; (UYSE-N) UNIV SEOANG; (YOON-I) YOON K B
 CYC 22
 PI WO 2001096106 A1 20011220 (200215)* EN 69p B32B027-00
 RW: AT BE CH CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE
 W: CN JP US
 KR 2001096777 A 20011108 (200226) B32B018-00
 KR 335966 B 20020510 (200272) B32B018-00
 ADT WO 2001096106 A1 WO 2000-KR1002 20000902; KR 2001096777 A KR
 2000-19667 20000414; KR 335966 B KR 2000-19667 20000414
 FDT KR 335966 B Previous Publ. KR 2001096777
 PRAI KR 2000-19667 20000414
 IC ICM B32B018-00; B32B027-00
 AB WO 200196106 A UPAB: 20020306
 NOVELTY - A zeolite-substrate composite comprising a zeolite
 monolayer or multilayer bound on the surface of substrate comprises:
 (i) substrate having hydroxyl groups, **metal**
substrate, or polymeric substrate;
 (ii) molecular sieve particles; and
 (iii) linker.
 The chemical bonding of the linker to the substrate and to the
 zeolite or its analog is by covalent-, ionic-, and coordination
 bonds.
 DETAILED DESCRIPTION - A zeolite-substrate composite comprising
 zeolite monolayer or multilayer which is bound on the surface of
 substrate comprises:
 (i) substrate consisting of substrate having hydroxyl groups,
metal substrate capable of being reacted with
 thiol groups, or polymeric **substrate** having
reactive functional groups in the main chain or side chains;
 (ii) molecular sieve particles consisting of porous oxides, or
 sulfides having surface hydroxyl groups; and
 (iii) linker derived from a linking compound having at least
 two functional groups at both terminal ends, one terminal end being
 chemically bonded to the substrate and the other being chemically
 bonded to the zeolite.
 The chemical bonding of the linker to the substrate and to the
 zeolite or its analog is attained by covalent-, ionic-, and
 coordination bonds. The linker is a linking chain or a combination
 of linking chains derived from organic linking compound(s)
 consisting of Z-L-X, MR'₄, R₃Si-L-Y, HS-L-X, HS-L-SiR₃, or HS-L-Y.
 Z = -SiR₃, or isocyanate;
 R = halo, 1-4C alkoxy or alkyl, at least one of three R
 substituents being halo or alkoxy;
 L = organic linking chain or linker from divalent hydrocarbon

residues, optionally substituted 1-17C alkyl, aralkyl, or aryl, which may have at least one heteroatom as O, N, or S;

X = reactive functional group as halo, isocyanate, tosyl, or azide;

R' = R, at least two of the four R' substituents being halo or alkoxy;

M = Si or a transitional metal as Ti or Zr;

Y = ligand having functional group consisting of hydroxyl, thiol, amine, ammonium, sulfone and its salt, carboxylic acid and its salt, acid anhydride, epoxy, aldehyde, ester, acrylate, isocyanate, sugar residues, double bond, triple bond, diene, diyne, alkyl phosphine, or alkyl amine and the functional group can exist in the middle or at the terminal ends of the ligands.

An INDEPENDENT CLAIM is also included for a method for the preparation of a zeolite-substrate composite having a zeolite monolayer or multilayer bound on the surface of the substrate comprising:

(a) chemically combining a substrate (S) or zeolite or its analog (Z) with a linking compound (L-A) having at least two terminal functional groups to prepare a substrate-linker (S-L-A) intermediate composite or a linker-zeolite (L-B-Z) intermediate composite;

(b) chemically combining the intermediate composites with zeolite or its analog or a substrate to prepare a substrate-linker-zeolite (S-L-Z) composite, and

(c) optionally calcining the resulting composite.

USE - The zeolite monolayer and multilayer can be used in fields related to separation of gas or liquid, linear or nonlinear optical device, opto-electronics, membrane, membrane catalyst, sensor carrier, photocell, or film formation using a second growth of zeolite.

ADVANTAGE - The zeolite monolayer or multilayer can be formed on the surface of various substrates via chemical bond. The zeolite-substrate composite is durable and the attached zeolite particles have a lightly oriented arrangement. The thickness of zeolite layer and the repeating number of zeolite layers can be conveniently controlled.

Dwg.0/28

TECH WO 200196106 A1UPTX: 20020306

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Substrate: The substrate consists of :

(i) oxides or mixed oxides of metals and non-**metals** having **surface** hydroxyl groups, such as silicon, aluminum, titanium, tin or indium, from groups consisting of quartz, mica, glass, ITO glass (glass deposited with indium oxide of tin), various conductible glass such as tin oxide (SnO₂), (porous) silica, (porous) alumina, (porous) titanium dioxide or **silicon wafer**;

(ii) **metals** capable of reacting with a thiol group, such as gold, silver, copper, or platinum;
(iii) polymers having various functional groups on their surface, such as polyvinyl chloride (PVC), or a Merrifield peptide resin;
(iv) semiconductive materials such as selenium-zinc (ZnSe), gallium-arsenic (GaAs), and indium-phosphor (InP);
(v) synthetic or natural zeolite or its analogs, or
(vi) natural materials of high molecular weight, which carry hydroxyl groups on their surfaces, such as cellulose, starch (amylose and amylopectin) or lignin.

Preferred Materials: The zeolite or its analog is:

(a) natural or synthetic zeolite;
(b) modified molecular sieves in which all or part of the silicon atoms in the zeolite skeleton are replaced with other atoms and consisting of AlPO₄ type, SAPO type, MeAPO type or MeAPSO type molecular sieve or its analogs;
(c) modified molecular sieve in which all or part of the aluminum atoms in the zeolite skeleton are replaced with other atoms consisting of boron, gallium, or titanium;
(d) molecular sieves combining the above modifications (b) and (c);
(e) porous metals or silicon oxides or their mixed oxides consisting of silicalite, MCM type porous silica, porous titanium dioxide or niobium dioxide, or
(f) porous molecular sieves prepared by using any other elements alone or in a mixture.

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Linker: The linker comprises in its chain a space linker derived from a space linking compound consisting of fullerene (60C, 70C), carbon **nanotubes**, alpha, omega-dialdehyde, dicarboxylic acid, dicarboxylic acid anhydride, amine-dendrimer, polyethyleneimine, alpha, omega-diamine, complex of (M(salen)) where M is metal element such as cobalt, nickel, chromium, manganese, or iron and salen is N,N'-bis(salicyliden)ethylenediamine), metal porphyrine derivatives, and any other coordination compounds.

ABEX WO 200196106 A1UPTX: 20020306

EXAMPLE - Glass plates were dipped to a reaction vessel containing 30 ml toluene. 0.5 ml (3-chloropropyl)trimethoxysilane was added. After heating for 3 hours, the glass plates were washed with toluene. Zeolite particles (0.02 g) were thoroughly dispersed in 30 ml toluene to give a zeolite suspension, in which the glass plates having surface 3-chloropropyl groups previously obtained were dipped and subjected to ultrasonic vibration for more than 30 seconds. After heating for 3 hours and cooling at room temperature, the glass plate coated with a zeolite monolayer was taken from the suspension, dipped in toluene, and subjected to ultrasonic vibration for 1 minute or more to remove any unreacted zeolite particles which were loosely attached on the zeolite monolayer.

L263 ANSWER 8 OF 11 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2001-389210 [41] WPIX

DNN N2001-286250 DNC C2001-118634

TI Processing a **nanotube** comprises selective **solid state reaction** between selected tube part and reactive material, and separating **end** of tube to define an **end**.

DC L03 P42 Q68 U12

IN ZHANG, Y

PA (NIDE) NEC CORP

CYC 2

PI US 2001004471 A1 20010621 (200141)* 9p B05D003-02

JP 2001172011 A 20010626 (200151) 5p C01B031-02

JP 3353768 B2 20021203 (200281) 5p C01B031-02

ADT US 2001004471 A1 US 2000-739477 20001218; JP 2001172011 A JP 1999-359579 19991217; JP 3353768 B2 JP 1999-359579 19991217

FDT JP 3353768 B2 Previous Publ. JP 2001172011

PRAI JP 1999-359579 19991217

IC ICM B05D003-02; C01B031-02

ICS B82B003-00; C01B021-064; H01L021-22

AB US2001004471 A UPAB: 20010724

NOVELTY - **Nanotube** processing comprises: causing selective reaction between part of a **nanotube** (2) and a reactive material so selected part becomes a reaction product; and separating the tube from the reaction to define an **end** of the **nanotube**.

DETAILED DESCRIPTION - The reactive material is preferably a substrate (1) with an edge, the edge preferably defined by a hole (1a) formed in the substrate. AN INDEPENDENT CLAIM is also included for: forming the **top** of a carbon **nanotube** (2), which comprises: selectively contacting part of the **nanotube** with a **solid state reactive** material having an edge; and heat treating to cause selective **solid state reaction** on a contacting region. The boundary between the reaction product and the **nanotube** is self-aligned to the edge of the **solid state reactive** material. The **top** of the **nanotube** is defined by separation as described.

USE - For **nanotube** production, of selected shape, without wet processing.

DESCRIPTION OF DRAWING(S) - The drawing shows a fragmentary cross-section of the carbon **nanotube**.

substrate 1

hole 1a

nanotube 2

Dwg.1/2

TECH US 2001004471 A1UPTX: 20010724

TECHNOLOGY FOCUS - METALLURGY - The **reactive** material (**substrate**) is preferably **Nb**.

FS CPI EPI GMPI

FA AB; GI

MC CPI: L04-C26

EPI: U12-B03X

L263 ANSWER 9 OF 11 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2001-193047 [20] WPIX

DNN N2001-137341 DNC C2001-058018

TI Synthesis of carbon **nanotubes** for use as electron emission source in field emission devices involves growing vertically aligned carbon **nanotubes** from nano-sized catalytic metal particle.

DC E36 L02 L03 Q68 V05 X16 X26

IN LEE, C; YOO, J; LEE, C J; YOO, J E

PA (LEEC-I) LEE C; (ILJI-N) ILJIN NANOTECH CO LTD; (LEEC-I) LEE C J

CYC 29

PI EP 1059266 A2 20001213 (200120)* EN 14p C01B031-02

R: AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK

NL PT RO SE SI

JP 2001020071 A 20010123 (200120) 10p C23C016-26

CN 1277145 A 20001220 (200121) C01B031-02

KR 2001049479 A 20010615 (200171) C01B031-02

US 6350488 B1 20020226 (200220) C23C016-26

KR 372332 B 20030217 (200353) C01B031-02

JP 3442032 B2 20030902 (200358) 11p C01B031-02

ADT EP 1059266 A2 EP 2000-304855 20000608; JP 2001020071 A JP 2000-175498 20000612; CN 1277145 A CN 2000-107805 20000612; KR 2001049479 A KR 2000-30352 20000602; US 6350488 B1 US 2000-590687 20000609; KR 372332 B KR 2000-30352 20000602; JP 3442032 B2 JP 2000-175498 20000612

FDT KR 372332 B Previous Publ. KR 2001049479; JP 3442032 B2 Previous Publ. JP 2001020071

PRAI KR 2000-30352 20000602; KR 1999-21855 19990611; KR 1999-22419 19990615

IC ICM C01B031-02; C23C016-26

ICS B01J023-745; B01J023-75; B01J023-755; B82B003-00; C23C016-46

AB EP 1059266 A UPAB: 20010410

NOVELTY - A metal catalyst layer, formed on a substrate (110), is etched to form isolated nano-sized catalytic metal particles (130P). Carbon **nanotubes** (150) are grown from every isolated nano-sized catalytic metal particle, by thermal chemical vapor deposition (CVD) in which a carbon source gas is supplied to thermal CVD apparatus to form carbon **nanotubes** vertically aligned over the substrate.

USE - For synthesizing carbon **nanotube** for use as electron emission source in field emission devices, white light

sources, lithium secondary batteries, hydrogen storage cells, transistors, cathode ray tubes.

ADVANTAGE - Mass synthesis of high purity carbon **nanotubes** vertically aligned over a large-size substrate, is enabled. High density catalytic metal particles can be formed isolated from each other, without agglomerating. The isolated nano-sized particles are obtained by uniform etching so that the **nanotubes** can be evenly distributed over the large-size substrates regardless of the positions on the substrates. The density, diameter and length of carbon **nanotubes** can be easily varied by adjusting the flow rate of etching gas and carbon source gas, and processing temperature and time. The carbon **nanotubes** can be easily purified in-situ by the process having maximum synthesis efficiency. The damages caused to carbon **nanotubes** by plasma energy, instability of the carbon **nanotube** structure due to synthesis at low temperature, and adherence of carbon particles to the surface of **nanotubes**, are prevented.

DESCRIPTION OF DRAWING(S) - The figure explains the growth of carbon **nanotubes** from isolated catalytic metal particles.

Substrate 110

Nano-sized catalytic metal particles 130P

Carbon **nanotubes** 150

Dwg. 5/8

TECH EP 1059266 A2 UPTX: 20010410

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Catalyst Layer: The metal catalyst layer is formed of cobalt, nickel, iron or their alloy.

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Method: The nano-sized catalytic metal particles are formed by gas etching method performed at 700-1000 degreesC by supplying hydrogen, hydride or preferably ammonia as etching gas which is thermally decomposed to create plasma, at a flow rate of 80-400 sccm for 10-30 minutes. The carbon **nanotubes** are formed at 700-1000 degreesC by supplying carbon source gas at a flow rate of 20-200 sccm for 10-60 minutes.

The catalytic metal particles and carbon **nanotubes** are formed in-situ in the same thermal CVD apparatus.

The etching gas is supplied along with carbon source gas to the CVD apparatus.

The catalytic metal particles are alternately formed by wet etching method using hydrogen fluoride series etchant or by photolithography using photoresist patterns as an etching mask.

An insulating layer is formed before forming the metal catalyst layer, to prevent **reaction** between **substrate** and **metal** catalyst layer.

The formed carbon **nanotubes** are purified in-situ using purifying gas selected from ammonia, hydrogen and/or oxygen.

The purifying gas and carbon source gas are then exhausted from CVD apparatus, using an inert gas.

ABEX EP 1059266 A2 UPTX: 20010410

EXAMPLE - A silicon oxide film was formed on a silicon substrate to a thickness of 1500 Angstrom. An iron film was formed on the silicon oxide film to a thickness of 100 nm by thermal deposition. The substrate with iron film was loaded into thermal CVD apparatus maintained at 760 Torr pressure and 950 degreesC. Ammonia gas was introduced into the apparatus at a flow rate of 100 sccm for 20 minutes to form isolated iron particles. While maintaining the temperature at 950 degreesC, acetylene gas was supplied at a flow rate of 40 sccm for 10 minutes to grow carbon nanotubes from each of the iron particles. Carbon nanotubes with diameter of 80 nm and length of 120 microns, were grown vertically and uniformly on the substrate.

L263 ANSWER 10 OF 11 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2001-102417 [11] WPIX

CR 2001-102374 [04]

DNN N2001-076058 DNC C2001-029904

TI Reversible storage of hydrogen involves exposing solid sorbent comprising metal-doped carbon-based material to hydrogen atmosphere.

DC E36 J06 Q69

IN CHEN, P; LIN, J

PA (CHEN-I) CHEN P; (LINJ-I) LIN J; (TNAK-I) TAN K L; (UYSI-N) UNIV SINGAPORE NAT; (TANK-I) TAN K L

CYC 92

PI WO 2000075559 A1 20001214 (200111)* EN 29p F17C011-00

RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC
MW NL OA PT SD SE SL SZ TZ UG ZW

W: AE AG AL AM AT AU AZ BA BB BG BR BY CA CH CN CR CU CZ DE DK
DM DZ EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP
KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX NO NZ PL PT
RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA
ZW

AU 2000046375 A 20001228 (200119) F17C011-00

ADT WO 2000075559 A1 WO 2000-SG58 20000425; AU 2000046375 A AU
2000-46375 20000425

FDT AU 2000046375 A Based on WO 2000075559

PRAI US 2000-517057 20000302; SG 1999-2930 19990604

IC ICM F17C011-00

ICS B01J020-20; C01B003-00

AB WO 200075559 A UPAB: 20010405

NOVELTY - A hydrogen is reversibly stored by exposing a solid sorbent comprising a metal-doped carbon-based material to a hydrogen atmosphere at 200-973 deg. K under 1 atm. or higher hydrogen pressure.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for:

(A) a material prepared by the method where the hydrogen storage capacity is up to 25 wt.%; and

(B) a hydrogen system comprising the alkali doped carbon-based material.

USE - For reversibly storing hydrogen.

ADVANTAGE - The invention increases the hydrogen storage capacity of a solid sorbent and enables the storage of hydrogen to be reversibly performed under ambient or higher pressure and moderate temperature. It economically makes an efficient sorbent.
Dwg.0/4

TECH WO 200075559 A1UPTX: 20010224

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Material: The metal doped carbon-based material is doped with alkali metal(s) from sodium, potassium, rubidium, cesium, or preferably lithium. It is doped with a mixture of alkali metals comprising lithium and other alkali metal(s), preferably potassium.

The alkali metal salt can be nitrates, hydroxides, carbonates, halides, acetates, hydrides, nitrites, preferably potassium or sodium-hydroxide.

The carbon material comprises graphite.

The metal-doped carbon-based material comprises at least one carbon material from carbon (nano)fibers, activated carbon, carbon nanotubes, graphite, or amorphous carbon.

The carbon material consists of stacked truncated nanocone type nanotubes, or carbon nanotubes with wall(s) having an average diameter of 1-35 nm or stacked truncated nanocones having an average outer diameter of 10-60 nm.

Preferred Method: The solid sorbent is preferably pretreated in an inert atmosphere at 373-1073 K and exposed to the hydrogen atmosphere at 400-900, preferably 200-700 K and 1-200 atm.

The alkali metal-doped carbon-based material is prepared by a solid state reaction comprising mixing carbon material(s) and alkali metal salt(s) and calcining the mixture under inert or reductive gas atmosphere.

The alkali metal salt is mixed with carbon based material in a molar ratio of 1:50-1:1, preferably 1:2. If the alkali metal salt is lithium, the chemical reaction is carried at 570-1073 K under hydrogen or inert gas atmosphere or if the alkali metal salt is sodium or potassium, the chemical reaction is carried at 573-1273 K under hydrogen atmosphere.

Preferred Composition: The hydrogen storage capacity is up to 20, preferably 20-25 wt.%. There is a rechargeability of at least 90% after 20 cycles of absorption-desorption.

ABEX WO 200075559 A1UPTX: 20010224

EXAMPLE - A nickel catalyst (100 mg) was pre-reduced at 700 degreesC in a purified hydrogen for 1 hour. The hydrogen was replaced by

purified methane at 700 degreesC for 1 hour. The catalyst with the material formed was cooled to room temperature under ambient pressure. The material was truncated stacked carbon nanocones with metal catalyst. The material was washed in dilute nitric acid and rinsed with distilled water. Stacked nanocones (600 mg) was mixed with lithium iodide (50 molar%) and heated in a purified helium at ambient pressure to 700 degreesC for 1 hour, and cooled to room temperature to form lithium-doped stacked truncated carbon nanocones. Lithium-doped nanocones (30 mg) was introduced as the purging and holding gas. After maintaining at room temperature for 60 minutes and purging with hydrogen at 30 psi, the temperature was increased to 973 K at 20 K/min for 1 hour and cooled to 623 K at 20 K/min for 2 hours. A weight increased of 25% was observed.

KW [1] 97153-0-0-0 CL PRD; 0031-88901 CL USE
FS CPI GMPI
FA AB; DCN
MC CPI: E05-U02; E11-S; E31-A02; E31-N04; E31-N04D; J06-B06
DRN 1532-P; 1532-U
CMC UPB 20010224
M3 *01* C101 C550 C810 M411 M720 M904 M905 N101 N104
DCN: R01532-K; R01532-P
M3 *02* A103 A111 A119 A137 A155 C106 C730 C801 C802 C803 C805 C806
C807 C810 M411 M781 M904 M905 N101 R044
DCN: 0031-88901-K; 0031-88901-U

L263 ANSWER 11 OF 11 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN
AN 2001-102374 [11] WPIX
CR 2001-102417 [11]
DNN N2001-076033 DNC C2001-029869
TI Reversible storage of hydrogen e.g. in fuel cells involves exposing
solid sorbent of metal-doped carbon-based material to hydrogen
atmosphere under specified conditions.
DC E36 J01 L03 Q69
IN CHEN, P; LIN, J; TAN, K L
PA (UYSI-N) UNIV SINGAPORE NAT
CYC 21
PI WO 2000074840 A1 20001214 (200111)* EN 16p B01J020-04
RW: AT BE CH CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE
W: CN JP
US 6471936 B1 20021029 (200274) C01B003-02
ADT WO 2000074840 A1 WO 1999-SG93 19990903; US 6471936 B1 US 2000-517057
20000302
PRAI SG 1999-2930 19990604
IC ICM B01J020-04; C01B003-02
ICS B01D053-02; B01J020-20; C01B003-00; F17C011-00
AB WO 200074840 A UPAB: 20021118
NOVELTY - Hydrogen is reversibly stored by exposing a solid sorbent
of metal-doped carbon-based material to a hydrogen atmosphere at

250-973 K under ambient or higher hydrogen gas pressure.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for:

(A) A method of preparing an alkali metal-doped carbon based material comprising mixing a carbon material with an alkali metal salt and calcining the mixture under an atmosphere of inert or reductive gas.

(B) A hydrogen storage system comprising the alkali metal-doped carbon-based material.

USE - Reversible storage of hydrogen e.g. in fuel cells for powering automobiles.

ADVANTAGE - Increased hydrogen storage capacity under ambient pressure and moderate temperature.

Dwg.0/2

TECH WO 200074840 A1UPTX: 20010224

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Material: The metal-doped carbon-based material is an alkali metal-doped carbon-based material. The carbon material is preferably carbon fiber, carbon **nanofiber** (10-60 nm average diameter), activated carbon, carbon **nanotubes** (5-30 nm average diameter), graphite or amorphous (disordered) carbon.

Preferred Salt: The salt is a nitrate, hydroxide, carbonate, halide, acetate, hydride or nitrite. The alkali metal is sodium (Na), potassium (K), rubidium (Rb), cesium (Cs) or lithium (Li).

Preferred Condition: The molar ratio of the alkali metal salt to the carbon material is 1:20-1:1.

TECHNOLOGY FOCUS - CHEMICAL ENGINEERING - Preferred Method: The alkali metal-doped carbon-based material is prepared by a **solid state reaction** between carbon material and alkali metal salt under helium, nitrogen, argon or hydrogen gas atmosphere. It is carried out at (i) 973-1273 degreesK when the alkali salt is sodium or potassium salt or (ii) 573-1073 degreesK when the alkali salt is lithium salt. The solid sorbent is exposed to hydrogen atmosphere at (a) 250-400 degreesK and 1-100 atmospheres when the alkali metal is sodium or potassium, or (b) 400-800 degreesK when the alkali metal is lithium.

=> d 1265 1-16 max

L265 ANSWER 1 OF 16 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2003-898693 [82] WPIX

DNN N2003-717200 DNC C2003-255457

TI Self-aligned carbon **nanotube** field effect transistor semiconductor device comprises carbon **nanotube** on substrate, source and drain formed at the **nanotube**, and gate formed over and separated from the carbon **nanotube** by

dielectric film.

DC L02 L03 U12
 IN APPENZELLER, J; AVOURIS, P; CHAN, K K; COLLINS, P G; MARTEL, R;
 WONG, H P
 PA (IBMC) INT BUSINESS MACHINES CORP
 CYC 100
 PI US 2003178617 A1 20030925 (200382)* 43p H01L029-06
 WO 2003081687 A2 20031002 (200382) EN H01L051-00
 RW: AT BE BG CH CY CZ DE DK EA EE ES FI FR GB GH GM GR HU IE IT
 KE LS LU MC MW MZ NL OA PT SD SE SI SK SL SZ TR TZ UG ZM ZW
 W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ
 DE DK DM DZ EC EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP
 KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ
 NO NZ OM PH PL PT RO RU SD SE SG SK SL TJ TM TN TR TT TZ UA
 UG US UZ VN YU ZA ZM ZW
 ADT US 2003178617 A1 US 2002-102365 20020320; WO 2003081687 A2 WO
 2003-US7269 20030219
 PRAI US 2002-102365 20020320
 IC ICM H01L029-06; H01L051-00
 ICS H01L031-109; H01L031-328; H01L031-336; H01L031-72
 AB US2003178617 A UPAB: 20031223
 NOVELTY - A self-aligned carbon **nanotube** field effect
 transistor semiconductor device comprises a carbon **nanotube**
 deposited on a substrate, a source formed at a first **end**
 of the carbon **nanotube**, a drain formed at a second
end of the carbon **nanotube**, and a gate (112)
 formed over a portion of the carbon **nanotube** and separated
 from the carbon **nanotube** by a dielectric film (111).
 DETAILED DESCRIPTION - An INDEPENDENT CLAIM is also included
 for a method for forming a self-aligned carbon **nanotube**
 field effect transistor comprising:
 (a) depositing a **nanotube** on a thermal oxide
 substrate that includes an alignment mark (101);
 (b) forming a metal contact (106-107) at each **end** of
 the **nanotube**, where a first metal contact is a source and
 a second metal contact is a drain;
 (c) depositing an amorphous silicon layer (108) over the
 device;
 (d) forming nitride spacers (110) on opposing sides of each
 metal contact;
 (e) depositing a high k dielectric film over the device;
 (f) oxidizing the amorphous silicon; and
 (g) forming a gate between the source and the drain, and over
 the **nanotube**.
 USE - Used as self-aligned carbon **nanotube** field
 effect transistor.
 ADVANTAGE - Good gate-to-**nanotube** coupling.
 DESCRIPTION OF DRAWING(S) - The figure shows a source/drain

first carbon **nanotube** field effect transistor.

Alignment mark 101

Thermal oxide 102

Silicon substrate 103

Metal contact 106-107

Amorphous silicon layer 108

Nitride spacers 110

Dielectric film 111

Gate 112

Dielectric layer 113

Passivation dielectric layer 113

Dwg.1i/6

TECH US 2003178617 A1UPTX: 20031223

TECHNOLOGY FOCUS - ELECTRONICS - Preferred Components: The substrate comprises a thermal oxide (102) deposited over a **silicon substrate** (103). A portion of the gate is further separated from the carbon **nanotube** by oxide layer. The gate is separated from the source and the drain by a nitride spacer. A passivation dielectric layer (113) is provided over the device. The gate wraps around the dielectric film and the carbon **nanotube** to contact a back side of the carbon **nanotube**. A metal catalyst is provided at a base of the carbon **nanotube**. The metal contact is formed by reactive ion etch.

Preferred Method: The metal contacts are formed using a photoresist.

Preferred Parameters: The thermal oxide has a thickness of 150 nm.

FS CPI EPI

FA AB; GI

MC CPI: L02-H04B; L04-E01A

EPI: U12-B03F2A; U12-D02A9

L265 ANSWER 2 OF 16 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2003-869977 [81] WPIX

DNN N2003-694474

TI Field electron emission apparatus manufacturing method for e.g. field emission display, involves performing plasma etching of carbon **nanotubes** formed by heating substrate having single crystal silicon-carbide, in vacuum.

DC U11 U12 V05

PA (ISEE) ISE ELECTRONICS CORP; (FINE-N) ZH FINE CERAMICS CENT

CYC 1

PI JP 2003297229 A 20031017 (200381)* 11p H01J009-02

ADT JP 2003297229 A JP 2002-99259 20020401

PRAI JP 2002-99259 20020401

IC ICM H01J009-02

AB JP2003297229 A UPAB: 20031216

NOVELTY - Several carbon **nanotubes** of an emitter are formed by heating a substrate (56) consisting of single crystal

silicon- carbide, in vacuum. The plasma etching of carbon **nanotubes** is performed in the presence of oxygen and the cap at the **end** of **nanotube** is removed. The carbon **nanotubes** are arranged on a cathode such that the carbon **nanotubes** extend towards an anode.

USE - Field electron emission apparatus for use as source of electron beam in display device e.g. field emission display (FED).

ADVANTAGE - Enables manufacturing a highly-reliable field electron emission apparatus requiring less emission starting potential.

DESCRIPTION OF DRAWING(S) - The figure shows the manufacturing process of the emitter. (Drawing includes non- English language text).

carbide material 36

silicon removal layer 38

substrate 56

Dwg.5/9

FS EPI

FA AB; GI

MC EPI: U11-C18B9; U12-B03D; U12-E01B2; V05-L01A3A; V05-L05D1A

L265 ANSWER 3 OF 16 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2003-511853 [48] WPIX

DNN N2003-406191 DNC C2003-136900

TI Etch mask formation, for semiconductor device fabrication, involves transferring nanocrystal silver film formed on water surface to resist layer formed on substrate and exposing resist layer to electronic beams.

DC G06 L03 P83 U11

IN CHOI, S H; LEUNG, M S; PRESSER, N; STUPIAN, G W

PA (AERO-N) AEROSPACE CORP

CYC 1

PI US 6440637 B1 20020827 (200348)* 9p G03C005-00

ADT US 6440637 B1 US 2000-613051 20000628

PRAI US 2000-613051 20000628

IC ICM G03C005-00

AB US 6440637 B UPAB: 20030729

NOVELTY - A nanocrystal silver film (16) formed on a water surface is transferred to a resist layer formed on a substrate to form a shadow mask. The resist layer is exposed to an electron beam through the shadow mask and is developed so as to form an etch mask patterned by the shadow mask.

DETAILED DESCRIPTION - Nanocrystal silver particles are mixed with decanedithiol and hexane to form a nanocrystal solution (14). The solution is dropped into water (12) to form the nanocrystal film. The film is pressurized on the water surface to align the nanocrystal particles into the shadow mask. The substrate is patterned by reactive ion etching to form a **nanowire** in

the substrate. After cleaning the **substrate**, the **semiconductor** contact material is deposited at the **ends** of the **nanowire**.

USE - Forming etch mask used for fabricating semiconductor device such as electronic, optoelectronic and magnetoelectronic devices.

ADVANTAGE - The nano size etch mask enables fabrication of nano size semiconductor device at a low cost.

DESCRIPTION OF DRAWING(S) - The figure shows the nanocrystal structure formation process.

Water 12

Nanocrystal solution 14

Nanocrystal silver film 16

Dwg.1/5

FS CPI EPI GMPI

FA AB; GI

MC CPI: G06-D06; G06-E02; G06-E04; G06-G; G06-G18; L04-C06A

EPI: U11-C04D; U11-C04F1

L265 ANSWER 4 OF 16 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2003-482530 [45] WPIX

DNN N2003-383691 DNC C2003-129151

TI Porous anodic alumina device used as thermoelectric device comprises non-aluminum substrate, and porous anodic alumina template.

DC L03 U14

IN AKINWANDE, A I; DRESSELHAUS, M S; HERZ, P R; LIN, Y; RABIN, O

PA (MASI) MASSACHUSETTS INST TECHNOLOGY

CYC 100

PI WO 2003046265 A2 20030605 (200345)* EN 35p C30B025-00

RW: AT BE BG CH CY CZ DE DK EA EE ES FI FR GB GH GM GR IE IT KE
LS LU MC MW MZ NL OA PT SD SE SK SL SZ TR TZ UG ZM ZW

W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ
DE DK DM DZ EC EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP
KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ
NO NZ OM PH PL PT RO RU SD SE SG SI SK SL TJ TM TN TR TT TZ
UA UG UZ VC VN YU ZA ZM ZW

ADT WO 2003046265 A2 WO 2002-US37732 20021125

PRAI US 2001-333403P 20011126

IC ICM C30B025-00

AB WO2003046265 A UPAB: 20030716

NOVELTY - A porous anodic alumina (PAA) device comprises non-aluminum substrate (10), and PAA template formed on the substrate.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for the following:

(1) a method of providing the PAA device comprising providing the non-aluminum substrate and forming the PAA template on the substrate;

(2) a multistage device comprising: a first stage having wafer, first adhesion layer provided on top surface of the wafer, PAA film (40) disposed the first adhesion layer, **nano wires** (50) disposed on the PAA film, and layer(s) disposed on top of the PAA film; and additional stage(s) having second adhesion layer provided on top surface of the first stage, second PAA film disposed on the second adhesion layer, second **nano wires** disposed on the second PAA film, and second layer(s) disposed on top of the second PAA film; and

(3) a thermoelectric device comprising: a substrate, a conductive layer disposed on the substrate, PAA film formed on the conductive layer, first set of **nano wires** disposed in a first position of the PAA, second set of **nano wires** disposed in second position of the PAA, an interconnect connecting first end of the first set of **nano wires** to a first end of the second set, and an insulating layer covering the interconnect.

USE - The device is used as thermoelectric device (claimed).

ADVANTAGE - The device provides PAA film on patterned conducting layer such that the resulting anodic film can be provided with 1 set of pores filled with 1 type of **nanowire** material and another set of pores with a different **nanowire** material. The film misses the barrier layer on patterned conducting layer such that pores or **nano wires** within the pores can be electrically addressed independently from each other.

DESCRIPTION OF DRAWING(S) - The figure is a schematic illustration of the process for fabricating the PAA film.

Substrate 10

Layers of material 20

Aluminum layer 30

Film 40

Nano wires 50

Dwg.1/11

TECH WO 2003046265 A2UPTX: 20030716

TECHNOLOGY FOCUS - ELECTRONICS - Preferred Components: The PAA device comprises **nano wires** formed within the template. It has a layer of material deposited on a top surface of the template.

Preferred Materials: The **substrate** includes

silicon wafer, oxidized **silicon**

wafer, or glass slide. The **nanowire** material

includes metals, semiconductors, oxides, polymers, or layers of at least 2 metals, semiconductors, oxides, and polymers arranged along at least 1 of a radial and an axial dimensions. The first material comprises n-type material. The other material comprises p-type material. The substrate comprises a rigid material for processing. Preferred Properties: The template is 50-500 microns thick. It has pores of approximately cylindrical shape and its length to diameter

ratio is 1-2500. It has a smooth surface with root-mean-square roughness down to approximately 5.5 Angstrom for all surface areas excluding pore openings. The conductive layer comprises valve metal. The template is partially removable from the substrate. Preferred Methods: The template is patterned to obtain a shape template differing in shape from that obtained by anodization without further processing. The **nano wires** are formed by filling pores of template with **nanowire** material. Forming the template includes depositing layer of alumina on the substrate, polishing the alumina, and anodizing it to form porous alumina substrate. The pores in the alumina structure are being widened.

FS CPI EPI
FA AB; GI
MC CPI: L03-E05A
EPI: U14-E02

L265 ANSWER 5 OF 16 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN
AN 2003-334244 [32] WPIX
DNN N2003-267815 DNC C2003-087005
TI Control method of arranging carbon **nanotube**
orientationally on the surface of substrate.
DC E36 L02 U11 U12
IN GUO, Y; XU, D; ZHANG, Y
PA (UYSH-N) UNIV SHANGHAI JIAOTONG; (UYSH-N) UNIV SHANG HAI JIAO TONG
CYC 34
PI CN 1388058 A 20030101 (200332)* C01B031-02
WO 2003086968 A1 20031023 (200370) ZH C01B031-02
RW: AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LU MC NL
PT RO SE SI SK TR
W: AU CA IN JP KR RU US
ADT CN 1388058 A CN 2002-111337 20020412; WO 2003086968 A1 WO 2003-CN195
20030317
PRAI CN 2002-111337 20020412
IC ICM C01B031-02
AB CN 1388058 A UPAB: 20030522
NOVELTY - The present invention belongs to the field of nanometer technology.

DETAILED DESCRIPTION - The control method of arranging carbon **nanotube** orientatedly on the surface of substrate includes: combining chain molecule with hydrophilic end and hydrophobic end to carbon **nanotube** and purifying and dissolving carbon **nanotube** in solvent; processing **solid substrate** to hydrophilic or hydrophobic one; controlling the surface pressure-surface area isothermal line of carbon **nanotube** film on water surface in a Langmuir water channel; transferring the carbon **nanotube** layer to the hydrophilic surface and hydrophobic surface of the processed

solid substrate to form Y-type LB film and measurement; and irradiating the carbon **nanotube** film with high-energy light.

ADVANTAGE - The present invention can control the arrangement direction of carbon **nanotube** and eliminate organic molecule successively.

Dwg.0/0

FS CPI EPI

FA AB

MC CPI: E31-N03; L02-H04B

EPI: U11-C01F; U11-C01J6; U12-B03F2

L265 ANSWER 6 OF 16 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2003-058440 [05] WPIX

DNN N2003-045344 DNC C2003-014935

TI Carbon **nanotube** array device for analyzing biological compounds, has **nanotube** tubule with proximal **ends** attached to substrate, and distal ends, and **metallic** material with **surface** for binding biological compounds.

DC B04 D16 J04 S03

IN FOURKAS, J; KELLEY, S O; NAUGHTON, M; REN, Z

PA (FOUR-I) FOURKAS J; (KELL-I) KELLEY S O; (NAUG-I) NAUGHTON M;
(RENZ-I) REN Z; (BOST-N) BOSTON COLLEGE

CYC 100

PI WO 2002079514 A1 20021010 (200305)* EN 56p C12Q001-68

RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC
MW MZ NL OA PT SD SE SL SZ TR TZ UG ZM ZW

W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ
DE DK DM DZ EC EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP
KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ
NO NZ OM PH PL PT RO RU SD SE SG SI SK SL TJ TM TN TR TT TZ
UA UG US UZ VN YU ZA ZM ZW

US 2002172963 A1 20021121 (200305) C12Q001-68

ADT WO 2002079514 A1 WO 2002-US645 20020109; US 2002172963 A1
Provisional US 2001-260758P 20010110, US 2002-42911 20020109

PRAI US 2001-260758P 20010110; US 2002-42911 20020109

IC ICM C12Q001-68

ICS C07H021-04; C07K005-00; C12M001-34; C12Q001-32; C12Q001-37;
G01N033-551; G01N033-573

AB WO 200279514 A UPAB: 20030121

NOVELTY - A carbon **nanotube** array device (I) comprising at least one **nanotube** tubule with proximal and distal ends, where the proximal end is attached to a **substrate**, and a **metallic** material capable of providing a surface for binding biological compounds coated or adsorbed on it, is new.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for:

(1) molecular sensor device comprising (I); and

(2) manufacture of the molecular sensor device.

USE - (I) is useful as carbon **nanotube** array device for analyzing biological compounds, and for measuring electrical conductivity or changes in electrical conductivity in short (less than 100 bp) and specific DNA sequences. The device is used for the rapid detection, fingerprinting and quantification of DNA from pathogenic organisms.

ADVANTAGE - The device provides a highly sensitive and specific response to target species requiring detection, but more desirably, provide a tunable response to a variety of chemical and biological species that pose pathological hazards to the environment. The ability to measure extremely small changes in electrical conductivity in the sensor is superior to conventional methods used for detecting DNA sequences. Furthermore, the sensors are adaptable to conventional silicon chip technology. The sensors have the ability to detect ultra low levels of a variety of biologically relevant pathogens in air, soil and water samples, and configured as a miniaturized portable device.

Dwg.0/16

FS CPI EPI

FA AB

MC CPI: B04-E01; B11-C08E; B11-C08E4; B11-C08E6; D05-H09; D05-H12;
D05-H18; J04-B01; J04-C02

EPI: S03-E14H4

CMC UPB 20030121

M6 *01* M905 P831 Q233 Q505 R501 R511 R515 R521 R528 R639

L265 ANSWER 7 OF 16 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2002-658008 [70] WPIX

DNN N2002-520190 DNC C2002-184804

TI Three-dimensional nanostructure used, e.g., as a field emission source for a field emission display comprises **substrate** having a **(semi)conductive surface** and **nanowire** sets extending from the surface.

DC A89 L03 U12 V05

IN BAL, M; RUSSELL, T P; TUOMINEN, M; URSACHE, A; TOUMINEN, M T

PA (BALM-I) BAL M; (RUSS-I) RUSSELL T P; (TUOM-I) TUOMINEN M; (URSA-I) URSACHE A; (UYMA-N) UNIV MASSACHUSETTS

CYC 100

PI WO 2002073699 A2 20020919 (200270)* EN 64p H01L029-15

RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC
MW MZ NL OA PT SD SE SL SZ TR TZ UG ZM ZW

W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ
DE DK DM DZ EC EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP
KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ
NO NZ OM PH PL PT RO RU SD SE SG SI SK SL TJ TM TN TR TT TZ
UA UG US UZ VN YU ZA ZM ZW

US 2002158342 A1 20021031 (200274)

H01L023-48

ADT WO 2002073699 A2 WO 2002-US7769 20020214; US 2002158342 A1
Provisional US 2001-275984P 20010314, US 2002-98222 20020314

PRAI US 2001-275984P 20010314; US 2002-98222 20020314

IC ICM H01L023-48; H01L029-15

ICS H01L035-00

AB WO 200273699 A UPAB: 20021031

NOVELTY - Multilayer nanostructure comprises a substrate surface having at least a portion that is conductive or semiconductive; and at least one set of **nanowires** extending from the (semi)conductive surface. One end of the **nanowires** is in electrical communication with the (semi)conductive surface.

DETAILED DESCRIPTION - The **nanowires** have the same length of at least 20 nm, preferably 100 nm.

The substrate is lithographically patterned and has a number of independently (semi)conductive surface regions. At least one set of **nanowires** can be in electrical communication with the independently (semi)conductive surface regions. Similarly, at least some independently (semi)conductive surface regions can each be in electrical communication with an individual set of **nanowires**.

The multilayer nanostructure may further include at least one (semi)conductive layer that contacts an opposite end of at least some of the **nanowires**, and that is in electrical communication with at least some of the **nanowires**.

The (semi)conductive layer can be in electrical communication with at least some of the **nanowires** in a number of sets.

Some **nanowires** can be made of a material different from that of other sets.

The **nanowires** can differ in their reduction potential and their semi-metal type. At least some of the wires can comprise magnetic material and can be multilayered. At least some of the **nanowires** can be modified to have magnetic properties, including magnetization direction, distinct from those of other sets.

INDEPENDENT CLAIMS are given for:

(a) a field emission display device comprising an addressable array of field emitters comprising a multilayer nanostructure in which a (semi)conductive layer is in electrical communication with at least some of the **nanowires** in a number of sets, and a phosphorescent screen;

(b) a thermoelectric cooling device comprising a multilayer nanostructure in which **nanowires** differ in their semi-metal type, and are of n and p types;

(c) a magnetic data storage device comprising a multilayer nanostructure in which at least some sets of **nanowires** have are modified to have magnetic properties distinct from those of

other sets, and where the **nanowires** have an aspect ratio of at least 20:1;

(d) a magneto-electronic device comprising a multilayer nanostructure in which a (semi)conductive layer is in electrical communication with at least some of the **nanowires** in a number of sets, and the **nanowires** comprise magnetic material;

(e) a method of interfacing an electrical connection with a multilayer nanostructure; and

(f) a magneto-transfer device consisting of a substrate surface comprising at least one electrode and an array of **nanowires** extending vertically from the surface in electrical communication with the electrode(s), where the array of **nanowires** is periodic on the tens of nanometer scale.

USE - Production of nanoscale devices, including field emission display devices, thermoelectric cooling devices, magnetic data storage devices, magneto-electronic devices, and magneto-transfer devices (claimed).

ADVANTAGE - Extremely high density of magnetic cylinders in the new films offers the possibility of using the system in the next generation of magnetic storage devices and giant magneto resistance magnetic field sensing devices. The processes used to produce the nanostructure devices are parallel, scalable and not subject to speed limitations experienced in nanofabrication techniques based on serial writing.

DESCRIPTION OF DRAWING(S) - The drawing shows an exposure process used to create a nanoporous array, and subsequently can be used to create an array of **nanowires**.

Dwg.1/22

TECH WO 200273699 A2UPTX: 20021031

TECHNOLOGY FOCUS - ELECTRONICS - Preferred Process: The method of interfacing an electrical connection with a multilayer nanostructure comprises:

(i) preparing a diblock copolymer on a substrate surface, at least a portion of which is (semi)conductive;

(ii) depositing a metal layer on at least a portion of the diblock copolymer layer;

(iii) orienting the diblock copolymer to form nanoscopic cylinders parallel to the each other and vertically oriented with respect to the surface;

(iv) removing at least a portion of one component from the oriented copolymer to form a patterned array of nanopores in the copolymer; and

(v) at least partially filling at least some of the nanopores with a material.

FS CPI EPI

FA AB; GI

MC CPI: A11-B06A; A11-C04B1; A12-E01; L03-B05C; L03-E05A; L03-G05D;

L04-E

EPI: U12-B03D; V05-D01C3; V05-D05C5A

PLE UPA 20021031

[1.1] 018; H0055 H0044 H0011

[1.2] 018; ND01; K9483-R; K9552 K9483; K9676-R; N9999 N7147
N7034 N7023; N9999 N7103-R N7034 N7023; N9999 N7090 N7034
N7023; B9999 B5425 B5414 B5403 B5276; Q9999 Q7512; Q9999
Q7498 Q7330; Q9999 Q7669; N9999 N7294; N9999 N6086; B9999
B5221 B4740; Q9999 Q8877-R Q8855; Q9999 Q7330-R; Q9999
Q7421-R Q7330

[1.3] 018; A999 A395

L265 ANSWER 8 OF 16 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2002-393935 [42] WPIX

DNN N2002-308881 DNC C2002-110819

TI Fabrication of single-walled **nanotube** probes for use in
atomic force microscopy by growing single-walled **nanotubes**
on substrate, imaging the substrate using atomic force microscope
with tip, and attaching **nanotube** to tip.

DC E36 L03 S03 V05

IN CHEUNG, C L; HAFNER, J H; LIEBER, C M

PA (HARD) HARVARD COLLEGE; (CHEU-I) CHEUNG C L; (HAFN-I) HAFNER J H;
(LIEB-I) LIEBER C M

CYC 97

PI WO 2002022499 A1 20020321 (200242)* EN 41p C01B031-02

RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC
MW MZ NL OA PT SD SE SL SZ TR TZ UG ZWW: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ
DE DK DM DZ EC EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP
KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ
NO NZ PH PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG
UZ VN YU ZA ZW

AU 2001094585 A 20020326 (200251) C01B031-02

US 2002112814 A1 20020822 (200258) B32B031-00

ADT WO 2002022499 A1 WO 2001-US29202 20010918; AU 2001094585 A AU
2001-94585 20010918; US 2002112814 A1 Provisional US 2000-233595P
20000918, US 2001-955738 20010918

FDT AU 2001094585 A Based on WO 2002022499

PRAI US 2000-233595P 20000918; US 2001-955738 20010918

IC ICM B32B031-00; C01B031-02

ICS G12B021-08

AB WO 200222499 A UPAB: 20020704

NOVELTY - Single-walled **nanotube** (SWNT) probes
are fabricated by growing single-walled **nanotubes** on a
substrate using chemical vapor deposition (CVD), imaging the
substrate using an atomic force microscope comprising a tip, and
attaching one of the SWNTs to the tip to produce a tip bearing a
SWNT.

USE - The method is used for fabricating **SWNT** probes for use in atomic force microscopy.

ADVANTAGE - The inventive method provides individual multiwalled **nanotube** tips and single-walled **nanotube** bundle tips in a simple manner since their fabrication can be carried out on many tips at once. The ultimate high-resolution tip would be an individual **SWNT** tip rather than a bundle.

DESCRIPTION OF DRAWING(S) - The figure depicts a model of the **nanotube** tip assembly process, transmission electron microscopy images of **SWNT** tips (**bottom** left panels), and an atomic force microscopy image of isolated **nanotubes** (**top** left).

Dwg.2/13

TECH WO 200222499 A1UPTX: 20020704

TECHNOLOGY FOCUS - INSTRUMENTATION AND TESTING - Preferred Method: The **SWNTs** are deposited normal to the surface of the substrate.

Growing of the **SWNTs** on a **silicon wafer** comprises depositing on the **wafer** a **metallic** catalytic material or treating the **wafer** with **metallic** colloid particles, placing the **silicon wafer** in a CVD furnace, and exposing the **silicon wafers** to a gaseous atmosphere comprising a carbon containing gas. Imaging the substrate further comprises applying a pulsed electric field. The method further comprises heating the tip bearing an **SWNT** or treating the tip bearing an **SWNT** with an electromagnetic field.

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Materials: The **substrate** is a **silicon wafer**. The **metallic** catalytic material includes metals, metal oxides, metallic salts, or metallic particles. It can be ferric salts, nickel salts, cobalt salts, platinum salts, molybdenum salts, or ruthenium salts. It is preferably ferric nitrate. The metal colloid is an iron colloid having diameters of 3-15 nm. The **SWNT** has a diameter of 2-13 preferably 3-5 nm. It can be nickel colloids, cobalt colloids, platinum colloids, platinum colloids, molybdenum colloids, or ruthenium colloids. The carbon **nanotube** can be a multi-walled **nanotube**.

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Materials: The **metallic** catalytic material is preferably in solution comprising alcohol which can be methanol, ethanol, or isopropanol. The carbon containing gas is ethylene. The tip bears an adhesive. The solution may comprise an organic solvent preferably toluene.

KW [1] 184601-0-0-0 CL PRD; 101932-0-0-0 CL; 91421-0-0-0 CL;
132606-0-0-0 CL; 132991-0-0-0 CL; 134276-0-0-0 CL; 1013-0-0-0 CL
FS CPI EPI

FA AB; GI; DCN
MC CPI: E05-U02; L03-H; N02; N03-D02; N07-K
EPI: S03-E02F; S03-E06B1; V05-F01A5; V05-F01B3; V05-F04B6A
DRN 0326-S; 0326-U
CMC UPB 20020704
M3 *01* G000 G830 M280 M320 M415 M510 M520 M530 M541 M720 M905 N120
N304 N441 N480 N515 N520 Q454
RIN: 90002
DCN: RA03UZ-K; RA03UZ-P
M3 *02* A428 C730 C810 M411 M730 M904 M905 Q421
DCN: RA03JM-K; RA03JM-C
M3 *03* A427 A940 A960 A970 C710 C730 M411 M417 M730 M904 M905 Q421
DCN: RA03JH-K; RA03JH-C
M3 *04* A678 A940 A960 A970 C710 C730 M411 M417 M630 M730 M904 M905
Q421
DCN: R12939-K; R12939-C
M3 *05* A542 A940 A960 C710 C730 M411 M417 M730 M904 M905 Q421
DCN: R13895-K; R13895-C
M3 *06* A544 A940 A960 C710 C730 M411 M417 M730 M904 M905 Q421
DCN: R19160-K; R19160-C
M3 *07* H7 H721 M210 M212 M320 M423 M510 M520 M530 M540 M610 M730
M904 M905 M910
DCN: R00326-K; R00326-S

L265 ANSWER 9 OF 16 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN
AN 2001-568042 [64] WPIX
DNN N2001-423181
TI Cold cathode for cathode ray tube has field-emission electron
sources which consist of **nano tubes** and whose
bottom ends are inserted to cathode electrodes.
DC V05
PA (SHAF) SHARP KK
CYC 1
PI JP 2001155620 A 20010608 (200164)* 7p H01J001-304
JP 3451048 B2 20030929 (200364) 7p H01J001-304
ADT JP 2001155620 A JP 1999-332675 19991124; JP 3451048 B2 JP
1999-332675 19991124
FDT JP 3451048 B2 Previous Publ. JP 2001155620
PRAI JP 1999-332675 19991124
IC ICM H01J001-304
ICS H01J009-02
AB JP2001155620 A UPAB: 20011105
NOVELTY - Field-emission electron sources (E), which consist of
nano tubes (11), have **bottom**
ends inserted to cathode electrodes (13). The upper-
end faces of the **nano tubes** are exposed
to gate insulating layer surfaces through the internal of a
metal substrate (7) and gate insulating layers

(6). The cathode electrodes are formed on both sides of the **metal substrate**.

DETAILED DESCRIPTION - A gate electrode (14) is formed on the upper surface of one gate insulating layer. The gate insulating layers are formed on the undersurface and the upper **surface** of the **metal substrate**. An INDEPENDENT CLAIM is also included for a manufacturing method for cold cathode.

USE - For cathode ray tube.

ADVANTAGE - Improves reliability of electric connection of field-emission electron source and cathode electrode. Reliable cold cathode is obtained since manufacture of cold cathode using **nano tube** becomes possible under low temperature.

DESCRIPTION OF DRAWING(S) - The figure shows the perspective diagram of the cold cathode.

Gate insulating layers 6

Metal substrate 7

Nano tubes 11

Cathode electrodes 13

Gate electrode 14

Field-emission electron sources E

Dwg.1/7

FS EPI

FA AB; GI

MC EPI: V05-D05C5

L265 ANSWER 10 OF 16 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2001-278461 [29] WPIX

DNN N2001-199581 DNC C2001-084699

TI Electron gun in cathode ray tube, has mono or multilayered carbon **nano tube** formed on silicon cone which is formed on electroconductive silicon layer, with leading end protruding from top portion of silicon cone.

DC L03 P85 V05

PA (KTKT-N) K & T KK

CYC 1

PI JP 2001068016 A 20010316 (200129)* 8p H01J001-304

ADT JP 2001068016 A JP 1999-245033 19990831

PRAI JP 1999-245033 19990831

IC ICM H01J001-304

ICS G09F009-30; H01J009-02; H01J029-04; H01J031-12

ICA C01B031-02

AB JP2001068016 A UPAB: 20010528

NOVELTY - A silicon cone (12) is formed on the surface of an electroconductive silicon layer (10). The layer (10) is doped with an amorphous silicon, polycrystalline silicon, single crystal silicon. A mono or multilayered carbon **nano tube**

(20) is formed on the silicon cone. The leading end (20A) of the **nano tube** is protruded from the top

portion (12A) of the silicon cone.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for the following: (i) Field emission display which includes an anode on which fluorescent material is formed for every pixel; (ii) Manufacturing method of electron gun which involves forming a **silicon** cone on **surface** layer on a substrate. The surface layer of the substrate is soaked in a solution containing chlorides such as ferrous chloride, ferric chloride, molybdenum oxide chloride and surfactant. The solvent of the solution is an alcohol. The vapor phase epitaxy of the carbon **nano tube** is carried out on the cone until the tube leading end projects from the top portion of the cone. The gas which contains carbon or hydrocarbon containing methane, ethane and propane is decomposed while heating. A grid (30) which controls the electron emission from the emitter is arranged opposing the carbon **nano tube** and an anode (40).

USE - Electron gun in cathode ray tube (CRT), field emission display (FED), etc.

ADVANTAGE - The electron gun which utilizes the axial direction edge of the carbon **nano tube** as an emitter edge, is provided.

DESCRIPTION OF DRAWING(S) - The figure shows the explanatory drawing of electron gun.

Electroconductive silicon layer 10
Silicon cone 12

Cone top portion 12A

Carbon **nano tube** 20

Tube leading end 20A

Grid 30

Anode 40

Dwg.1/6

FS CPI EPI GMPI

FA AB; GI

MC CPI: L03-C03

EPI: V05-D01B3C; V05-D01C5; V05-D05C5A; V05-D06A1E

L265 ANSWER 11 OF 16 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2001-167664 [17] WPIX

DNN N2001-120860 DNC C2001-049912

TI Carbon-based tip for scanning probe microscopy used to reveal chemical characteristics of sample, has specific structure.

DC E19 J04 S03

IN JOSELEVICH, E; LIEBER, C M; WONG, S S; WOOLLEY, A T

PA (HARD) HARVARD COLLEGE

CYC 1

PI US 6159742 A 20001212 (200117)* 10p G01N021-00

ADT US 6159742 A Provisional US 1998-122051P 19980605, US 1999-326100
19990604

PRAI US 1998-122051P 19980605; US 1999-326100 19990604

IC ICM G01N021-00

ICS G01N033-544

AB US 6159742 A UPAB: 20020114

NOVELTY - A carbon-based tip for scanning probe microscopy used to reveal chemical characteristics of sample has structure (I).

DETAILED DESCRIPTION - The carbon-based tip for scanning probe microscopy used to reveal chemical characteristics of sample comprises a structure of formula $X-(L-M)_n$ (I).

$n = 1-100$;

X = carbon-based **nanotube** having first and second ends, where second end is attached to cantilever configured for microscopy;

L = lithium group bonded to first **end** of **nanotube**;

M = molecular probe bonded to linking group.

INDEPENDENT CLAIMS are also included for:

(i) probing of a sample by scanning probe microscopy which involves sensing surface of sample with carbon-based **nanotube** having molecular probe linked to one **end** of **nanotube**, to reveal chemical characteristics of sample; and

(ii) removal of molecular probe from carbon-based tip which involves providing carbon-based tip including **nanotube** and molecular probe near the **metal surface** and impressing a voltage between **nanotube** and **metal surface**.

USE - For scanning probe microscopy (claimed) such as atomic, optical, transmission electron, scanning electron, interfacial, colloid probe, optical tweezer and surface force microscopy used to reveal chemical characteristics of sample (claimed) such as microscopic topography and surface properties of sample, properties of chemical and biological systems, adhesion and frictional forces of sample and functionalities associated with chemical and biological process, titrate acidic and basic groups to image patterned samples with chemical sensitivity, measure binding force between single protein-ligand pairs, sense and locate hydrophobic areas of sample and active or binding site of an enzyme, ligand-receptor interaction of biotin-streptavidin, perform force-displacement measurements on mica surfaces containing immobilized streptavidin, functionalize with polypeptides, actin, myosin, nucleic acids, nucleosides, nucleotides, bacteria, viruses, organelles, chromosomes, pharmaceutical compounds, polysaccharides, lipids, enzymes, substrates, antigens and antibodies, image self assembled polymeric and biological materials, map functional groups with molecular resolutions and link catalyst such as transition metal complexes, Vaska's complex used for oxidative addition, hydrogenation catalysts, i.e., Wilkinson's catalyst,

hydroformylation catalysts, hydrosilylation catalyst and epoxidation catalysts such as Jacobsen's catalyst and hydrolytic catalysts used for performing localized hydrolysis to create tools that can modify or create structures at molecular scale.

ADVANTAGE - Scanning probe microscopies comprising carbon-based tip forms high sensitive and accurate image. Modifications of carbon-based **nanotube** tips enable facile creation of chemically well defined probes sensitive to specific intermolecular interactions. The **nanotubes** with high aspect ratios enables probing into deep crevices of microelectronic circuits. The **nanotube** has unique ability to flex and buckle elastically which enables effective handling of delicate organic and biological samples. The **nanotubes** show significantly improved lateral resolution (less than 4 nm) due to smaller effective radii of tips compared with commercial silicon probes. The tip is chemically well defined to include the specific molecular probe. The **nanotube** can sustain large deflection loads at large deflection angle without permanent deformation. The tubes have very distinct chemical functionalities. Direct coupling reactions on **nanotube** tips enables creation of chemically sensitive imaging probes. The **nanotube** tips enables effective probing of biological and chemical systems at nanometer scale.

Dwg.0/3

TECH US 6159742 A UPTX: 20020114

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Linkage: The molecular probe is linked through amino or amido group to the **end of nanotube**.

TECHNOLOGY FOCUS - ELECTRICAL POWER AND ENERGY - Preferred Voltage: The voltage impressed between **nanotube** and **metal surface** to remove molecular probe is 1-50 V.

ABEX US 6159742 A UPTX: 20020114

DEFINITIONS - Preferred Definitions:

L = amino, amido, carbonyl, carboxyl, alkyl, aryl, ether or ester, preferably amino or amido;

M = hydrogen, hydroxy, amino, 1-20C alkyl, 2-20C alkenyl, 2-20C alkynyl, 1-20C heteroalkyl, 2-20C heteroalkenyl, 3-8C cycloalkyl, 3-8C cycloalkenyl, 4-8C aryl, 2-30C heterocyclyl, polypeptide, polysaccharide, lipid or polynucleotide.

KW [1] 0033-52501 CL USE

FS CPI EPI

FA AB; DCN

MC CPI: E05-U; E05-U02; J04-B01

EPI: S03-E14H4

CMC UPB 20020114

M3 *01* D010 D019 D020 D029 D040 D049 F010 F012 F013 F014 F015 F016
F019 F020 F021 F029 F113 F123 F199 G001 G002 G010 G011 G012
G013 G014 G015 G016 G017 G018 G019 G020 G021 G022 G029 G030

G039 G040 G050 G060 G111 G112 G113 G221 G299 G553 G563 G830
H100 H101 H102 H141 H142 H143 H181 H182 H183 H401 H402 H403
H404 H405 H422 H423 H424 H441 H442 H443 H444 H481 H482 H483
H484 H521 H522 H523 H541 H542 H543 H581 H582 H583 H584 H589
H715 H721 H722 H723 H731 J011 J012 J013 J014 J131 J132 J133
J171 J172 J173 J231 J232 J241 J242 J271 J272 J273 J331 J332
J341 J342 J371 J372 J373 J581 J582 J583 L640 L660 L699 M111
M112 M113 M114 M115 M119 M121 M122 M123 M124 M125 M126 M129
M132 M135 M139 M141 M149 M150 M210 M211 M212 M213 M214 M215
M216 M220 M221 M222 M223 M224 M225 M226 M231 M232 M233 M240
M262 M272 M273 M280 M281 M282 M283 M311 M312 M313 M314 M315
M316 M320 M321 M322 M323 M331 M332 M333 M334 M340 M342 M343
M344 M349 M371 M372 M373 M381 M383 M391 M392 M393 M412 M413
M414 M415 M417 M424 M510 M511 M512 M513 M520 M521 M522 M523
M530 M531 M532 M533 M541 M542 M543 M610 M740 M781 M904 M905
P832 Q010 Q435 Q505 R023 R043
RIN: 90002
DCN: 0033-52501-K; 0033-52501-U

L265 ANSWER 12 OF 16 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 2000-422677 [36] WPIX

DNN N2000-315464 DNC C2000-127747

TI Carbon **nanotube** field emission device for flat panel
displays includes a bundle of carbon **nanotubes**, which is
oriented perpendicular to a refractory substrate.

DC E36 L03 U12 V05

IN CHAPLINE, M; DAI, H; FAN, S; FRANKLIN, N; TOMBLER, T

PA (CHAP-I) CHAPLINE M; (DAIH-I) DAI H; (FANS-I) FAN S; (FRAN-I)

FRANKLIN N; (TOMB-I) TOMBLER T; (STRD) UNIV LELAND STANFORD JUNIOR

CYC 22

PI WO 2000030141 A1 20000525 (200036)* EN 20p H01J001-30

RW: AT BE CH CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE

W: CA JP

US 6232706 B1 20010515 (200129) H01J001-02

US 2001019238 A1 20010906 (200154) H01J001-02

EP 1131838 A1 20010912 (200155) EN H01J001-30

R: AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE

JP 2002530805 W 20020917 (200276) 19p H01J001-304

ADT WO 2000030141 A1 WO 1999-US26232 19991104; US 6232706 B1 US

1998-191728 19981112; US 2001019238 A1 Cont of US 1998-191728

19981112, US 2001-858783 20010515; EP 1131838 A1 EP 1999-972363

19991104, WO 1999-US26232 19991104; JP 2002530805 W WO 1999-US26232

19991104, JP 2000-583057 19991104

FDT US 2001019238 A1 Cont of US 6232706; EP 1131838 A1 Based on WO

2000030141; JP 2002530805 W Based on WO 2000030141

PRAI US 1998-191728 19981112; US 2001-858783 20010515

IC ICM H01J001-02; H01J001-30; H01J001-304

ICS B01J023-745; B01J037-02; B01J037-14; B05D005-12; C01B031-02;

C23C014-04; C23C014-14; C23C016-00; H01J001-05; H01J001-14;
H01J001-38; H01J001-48; H01J009-02; H01J019-06; H01J029-04

ICA C23C016-26

AB WO 200030141 A UPAB: 20000801

NOVELTY - A field emission device (20) comprises a bundle (28) of parallel carbon **nanotubes** that extends from a catalyst material (26) in a direction perpendicular to the refractory substrate (22).

DETAILED DESCRIPTION - An INDEPENDENT CLAIM is also included for a method of making bundles of aligned carbon **nanotubes** on a **top** surface of a refractory substrate comprising:

(a) depositing a catalyst material on the top surface of the refractory substrate; and

(b) exposing the catalyst material to a carbon-containing gas at an elevated temperature.

USE - For flat panel displays.

ADVANTAGE - The invention can be scaled to large substrates.

DESCRIPTION OF DRAWING(S) - The figure shows a field emission device.

Field emission device 20

Refractory substrate(26) Catalyst material 22

Carbon **nanotube** bundle 28

Dwg.1/5

TECH WO 200030141 A1UPTX: 20000801

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Material: The **substrate** is a **silicon substrate**. The catalyst material comprises iron oxide particles.

TECHNOLOGY FOCUS - ELECTRONICS - Preferred Method: The oxidation of the iron film is performed by exposing the iron film to oxygen at an elevated temperature. The deposition of the iron film is performed by physical vapor deposition.

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Gas: The carbon-containing gas is ethylene.

KW [1] 2211-0-0-0 CL PRD; 105439-0-0-0 CL PRD; 107015-0-0-0 CL;
1013-0-0-0 CL

FS CPI EPI

FA AB; GI; DCN

MC CPI: E08-A; E10-J02C4; E31-N03; L03-C04; L03-G05; N02-A01

EPI: U12-B03D; V05-D01C5; V05-D05C5A

DRN 0326-S; 0326-U; 1508-P; 1508-U; 1666-U; 1669-P; 1669-U

CMC UPB 20000801

M3 *01* C106 C810 M411 M720 M782 M904 M905 M910 N221 N309 N311 N313
N441 N515 Q454

DCN: R01669-K; R01669-M; R01669-P; R05085-K; R05085-M;
R05085-P

M3 *02* A426 A940 C108 C550 C730 C801 C802 C803 C804 C805 C807 M411

M720 M782 M904 M905 N120 N514 Q421 Q454
 DCN: R03239-K; R03239-M; R03239-P
 M3 *03* B114 C810 M411 M782 M904 M905 M910 Q454
 DCN: R01666-K; R01666-M
 M3 *04* H7 H721 M210 M212 M320 M416 M610 M730 M904 M905 M910
 DCN: R00326-K; R00326-S

L265 ANSWER 13 OF 16 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN
 AN 2000-136897 [12] WPIX
 DNN N2000-102359 DNC C2000-041968
 TI Freestanding aligned carbon **nanotubes**.
 DC A60 B07 E36 J04 L03 S03 V05 X16
 IN HUANG, Z; REN, Z; WANG, D; WANG, J H
 PA (UYNY) UNIV NEW YORK STATE RES FOUND; (HUAN-I) HUANG Z; (RENN-I) REN
 Z; (WANG-I) WANG D; (WANG-I) WANG J H
 CYC 24
 PI WO 9965821 A1 19991223 (200012)* EN 67p C01B031-00
 RW: AT BE CH CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE
 W: CA JP KR MX
 EP 1089938 A1 20010411 (200121) EN C01B031-00
 R: AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
 KR 2001074667 A 20010808 (200210) C01B031-02
 JP 2002518280 W 20020625 (200243) 68p C01B031-02
 MX 2000012681 A1 20020201 (200362) C01B031-00
 US 2003203139 A1 20031030 (200372) B27N001-00
 ADT WO 9965821 A1 WO 1999-US13648 19990618; EP 1089938 A1 EP 1999-928735
 19990618, WO 1999-US13648 19990618; KR 2001074667 A KR 2000-714484
 20001219; JP 2002518280 W WO 1999-US13648 19990618, JP 2000-554654
 19990618; MX 2000012681 A1 WO 1999-US13648 19990618, MX 2000-12681
 20001218; US 2003203139 A1 Provisional US 1998-89965P 19980619,
 Provisional US 1998-99708P 19980910, US 1999-336126 19990618
 FDT EP 1089938 A1 Based on WO 9965821; JP 2002518280 W Based on WO
 9965821; MX 2000012681 A1 Based on WO 9965821
 PRAI US 1998-99708P 19980910; US 1998-89965P 19980619; US 1999-336126
 19990618
 IC ICM B27N001-00; C01B031-00; C01B031-02
 ICS C23C016-00; C23C016-26; C23C016-30; D01F009-12; D01F009-127;
 H01J001-30; H01J001-304; H01J009-02; H01J029-04; H01J031-12;
 H01J037-073; H01M004-02; H01M008-06; H01M008-10
 AB WO 9965821 A UPAB: 20001006
 NOVELTY - Aligned carbon **nanotubes** are attached to a
 substrate at a density greater than 10,000 per square millimeter.
 DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included
 for:
 (1) a product as above but where the aligned carbon
nanotubes are attached to a substrate at a density no
 greater than 100 per square millimeter; and
 (2) a method of forming the products by exposing the substrate

to a plasma under conditions effective for growth of the **nanotubes**, in the presence of a catalyst gas and a carbon source gas.

USE - The obtained product is used for a field emission display, an electron emitter, a scanning electron microscope, a battery, a fuel cell, a composite material, a high temperature superconductor, an electromagnetic interference shield and a micro electrode (all claimed).

ADVANTAGE - Precise control of the formation, and well defined spacing of the **nanotubes**.

DESCRIPTION OF DRAWING(S) - The drawing shows a schematic view of a micro electrode produced by the above method.

micro electrode 600

conductive substrate 602

aligned carbon **nanotubes** 604

electroconductive microfibre 608

Dwg.26/26

TECH WO 9965821 A1 UPTX: 20000308

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Product: The **nanotubes** extend perpendicularly to, non-perpendicular to or parallel to the substrate, and have a diameter of 50-500 nm. The substrate is glass, silica, quartz, iron (alloy), cobalt (alloy), nickel (alloy), platinum or ceramic, preferably a glass plate or **silicon wafer**. All the **nanotubes** have a cap distal from the substrate made of iron (alloy), cobalt (alloy) or preferably nickel (alloy). The **nanotubes** are filled with hydrogen, lithium ions, bismuth, lead telluride or bismuth telluride.

Preferred Method: The plasma treatment is applied at a pressure of 1-20 Torr. The carbon source gas is an (un)saturated linear, branched or cyclic hydrocarbon with up to six carbon atoms, preferably acetylene, ethylene or benzene. The catalyst gas is ammonia or nitrogen. The volume ratio of carbon source gas to catalyst gas is 1:2 to 1:10, and the substrate is exposed to the plasma at 300-700 degrees C. Prior to exposure to the plasma, the substrate may be coated with:

(a) a catalyst film of iron (alloy), cobalt (alloy) or preferably nickel (alloy) by RF magnetron sputtering to a thickness of at least 15 nm; or

(b) catalyst nano-dots of iron (alloy), cobalt (alloy) or preferably nickel (alloy) by electron beam evaporation, thermal evaporation or magnetron sputtering, each nano-dot allowing the formation of one **nanotube**.

The **nanotube** diameter is directly related to the catalyst film thickness and the **nanotube** length varies in direct or inverse proportion to the plasma intensity. The cap is removed from the **nanotube ends** by nitric acid etching or argon ion sputtering. The **nanotubes** are enclosed after

filling with a desired material by electrochemical deposition or magnetron sputtering of a metal.

TECHNOLOGY FOCUS - BIOLOGY - The **nanotubes** may be filled with a pharmacological agent.

L265 ANSWER 14 OF 16 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN
 AN 1999-582607 [50] WPIX
 DNN N1999-430403 DNC C1999-169632
 TI Nanostructure carbon **nanotube** electron emitting device and method.
 DC L03 S03 U11 U12 V05
 IN DEN, T; IWASAKI, T
 PA (CANO) CANON KK; (DENT-I) DEN T; (IWAS-I) IWASAKI T
 CYC 27
 PI EP 951047 A2 19991020 (199950)* EN 44p H01J001-30
 R: AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK
 NL PT RO SE SI
 JP 2000031462 A 20000128 (200017) 22p H01L029-06
 US 6278231 B1 20010821 (200150) H01J001-02
 US 2001028872 A1 20011011 (200162) D01C005-00
 ADT EP 951047 A2 EP 1999-106041 19990325; JP 2000031462 A JP 1999-47540
 19990225; US 6278231 B1 US 1999-276667 19990326; US 2001028872 A1
 Div ex US 1999-276667 19990326, US 2001-867611 20010531
 FDT US 2001028872 A1 Div ex US 6278231
 PRAI JP 1999-47540 19990225; JP 1998-98114 19980327
 IC ICM D01C005-00; H01J001-02; H01J001-30; H01L029-06
 ICS C25D011-04; D01F009-12; G01N027-414; H01J001-304; H01J009-02;
 H01L021-3063
 ICA C01B031-02
 AB EP 951047 A UPAB: 19991201
 NOVELTY - A nanostructure comprises a substrate (11) having a **surface** of **semiconductor**, noble metal, Mn, Fe, Co, Ni, Cu or carbon with an anodized film (13) on the surface having a nanohole through to the substrate which has a constriction between the substrate and the film surface.
 DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for the following:
 (a) an electron emitting device comprising the nanostructure above having an electrode on the film surface facing the substrate (11);
 (b) a method of making a nanostructure as above comprising forming and anodizing an Al film on the substrate and terminating anodization when the anodization current decreases from a steady-state value; and
 (c) a method of forming a carbon **nanotube** additionally comprising electrodepositing a fine catalyst particle

at the **bottom** of the **nanotube** and growing carbon **nanotubes** from this.

USE - As nanostructures including carbon **nanotubes** for electron-emitting and micro devices such as quantum effect devices, electrochemical sensors, magnetic memories and photonic devices

ADVANTAGE - **Nanotubes** are completely cut through to the substrate and are uniform.

DESCRIPTION OF DRAWING(S) - A cross-section of a **nanotube** structure is shown.

substrate 11

anodized film 13

nanohole 14

constriction 16

Dwg.2/27

FS CPI EPI

FA AB; GI

MC CPI: L03-G

EPI: S03-E03C; U11-C18B9; U12-B03D; U12-B03X; V05-L01A; V05-M03A

L265 ANSWER 15 OF 16 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 1998-476567 [41] WPIX

DNC C1998-143783

TI Prodn. of carbon **nanotube** - by introducing a precursor gas contg. a material for carbon introduction in the reaction container with the substrate previously forming a carbon **nanotube** growing starting region on its surface placing in the reaction container.

DC E36 L03 S03 V05

PA (CANO) CANON KK

CYC 1

PI JP 10203810 A 19980804 (199841)* 11p C01B031-02

ADT JP 10203810 A JP 1997-8461 19970121

PRAI JP 1997-8461 19970121

IC ICM C01B031-02

ICS D01F009-127; G01N037-00

AB JP 10203810 A UPAB: 19981014

A carbon tube is grown on a substrate placed in a reaction container. The prodn. comprises: (a) introducing a precursor gas contg. a material for carbon introduction in the reaction container with the substrate previously forming a carbon **nanotube** growing starting region on its surface placing in the reaction container; (b) generating plasma by DC glow discharge in the reaction container to form a carbon **nanotube** on the substrate.

USE - The method produces the carbon **nanotube** used in functional materials, including an electron discharging material, a probe for scanning tunnel microscope, thin line for micromachine, or

quantum effect device.

ADVANTAGE - The carbon **nanotube** is directly formed on the substrate at comparatively low substrate temps. No refining treatment is required. One **end** of the carbon **nanotube** is connected to the substrate. The substrate is used as an electrode, allowing the use as an electronic functional material.

Dwg.0/5

FS CPI EPI

FA AB; DCN

MC CPI: E31-N04; L02-A; L02-H04; L03-H
EPI: S03-E02F; V05-F01A5; V05-F04B6A

DRN 1669-P; 1669-U

CMC UPB 19990127

M3 *01* C106 C810 M411 M720 M903 M904 M910 N104 Q454 R033

DCN: R01669-K; R01669-P

L265 ANSWER 16 OF 16 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN

AN 1997-064334 [06] WPIX

DNN N1997-052979 DNC C1997-021145

TI Single electron **nanowire** devices and method of mfr. - uses electrodeposition with oxide microporous templates to give a high density of tunnel junction devices.

DC L03 U11 U12

IN MOSKOVITS, M; XU, J M

PA (MOSK-I) MOSKOVITS M; (XUJM-I) XU J M

CYC 1

PI US 5581091 A 19961203 (199706)* 8p H01L029-06

ADT US 5581091 A US 1994-352151 19941201

PRAI US 1994-352151 19941201

IC ICM H01L029-06

ICS H01L021-302

AB US 5581091 A UPAB: 19970205

Mfg. single-electron devices consisting of an array of elements each comprising at least two conductors sepd. by an ultrathin insulator or semiconductor layer and with at least one conductor in each element being a **nanowire**, comprises providing a **metal substrate** (10) sheet or foil of Al, Ti, Nb, Ta or alloys. This is electrolytically anodised in an acid bath to deposit an oxide film (12) having parallel axial micropores of uniform dia. in the range 1-500 nm and less deep than the film so as to leave an ultrathin oxide layer at the bottom (16). A conductive material is deposited in the pores to form a **nanowire** (22) contacting the **bottom** oxide and a macro metal is deposited over the **ends** of the **nanowires** as external electrical contacts (26).

Also claimed are single-electron devices prepd. as above and having ultrathin insulating layers contacting both **ends** of

the **nanowires** with macro metal layers contacting these.

USE - As single-electron devices for diodes, transistors, etc. and high-density computer chips

ADVANTAGE - Densely packed and uniform **nanowires** of controllable length and dia. are formed with densities of 1×10^{10} cm⁻² being realised.

Dwg.2/4

FS CPI EPI

FA AB; GI

MC CPI: L04-E

EPI: U11-C18B9; U12-B03X

=> file hca

FILE 'HCA'

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=> d 1266 1-3 cbib abs hitind

L266 ANSWER 1 OF 3 HCA COPYRIGHT 2004 ACS on STN

137:233116 Mineralization of Single Flexible Polyelectrolyte Molecules.

Minko, Sergiy; Kiri, Anton; Gorodyska, Ganna; Stamm, Manfred (Institut fuer Polymerforschung Dresden, Dresden, 01069, Germany). Journal of the American Chemical Society, 124(34), 10192-10197 (English) 2002. CODEN: JACSAT. ISSN: 0002-7863. Publisher: American Chemical Society.

AB Conformation of a single flexible polyelectrolyte mol. with a hydrophobic backbone in aq. soln. is effected by the interplay of the short-range intramol. attraction and the long-range Coulomb repulsion. The conformation can be frozen if the mol. is trapped by a **solid substrate**. With this approach, we prepd. the range of single mol. templates from poly(2-vinylpyridine) (P2VP) deposited on the **surface** of **Si-wafer** or mica in different conformations from an elongated wormlike coil to compact globule. Pd(+2) was coordinated by P2VP via an ion exchange reaction exposing the samples to palladium acetate acidic aq. soln. In the next step, Pd(+2) was reduced by dimethylamine borane. This route results in wire-shaped metallic nanoparticle assemblies of about 2-5 nm in diam. and 50-700 nm in length. The conformation and size of the underlaying polyelectrolyte mols. det. the dimensions of nanoparticles.

CC 36-2 (Physical Properties of Synthetic High Polymers)

Section cross-reference(s): 62

ST conformation flexible polyelectrolyte trapped **solid substrate** mineralization; polyvinylpyridine polyelectrolyte

conformation trapped **solid substrate**
mineralization

- IT Polymer chains
(conformation; reactive mineralization of single flexible polyelectrolyte mols. having frozen conformation on **solid substrates**)
- IT Coating process
(metalization; reactive mineralization of single flexible polyelectrolyte mols. having frozen conformation on **solid substrates**)
- IT Ion exchange
Nanowires
Polyelectrolytes
Size distributions
(prepn. and properties of metalized polyelectrolyte on **solid substrates** having frozen conformation)
- IT Mica-group minerals, uses
(**substrate; reactive** mineralization of single flexible polyelectrolyte mols. having frozen conformation on **solid substrates**)
- IT 187849-90-7, Palladium chloride (PdCl₄)
(poly(2-vinylpyridine) composites; reactive mineralization of single flexible polyelectrolyte mols. having frozen conformation on **solid substrates**)
- IT 7440-05-3D, Palladium, poly(2-vinylpyridine) complexes, reduced
25014-15-7D, Poly(2-vinylpyridine), palladium complexes, reduced
(prepn. and properties of metalized polyelectrolyte on **solid substrates** having frozen conformation)
- IT 74-94-2, Dimethylamine borane 3375-31-3
(reactive mineralization of single flexible polyelectrolyte mols. having frozen conformation on **solid substrates**)
- IT 25014-15-7, Poly(2-vinylpyridine)
(reactive mineralization of single flexible polyelectrolyte mols. having frozen conformation on **solid substrates**)
- IT 7440-21-3, Silicon, uses
(**substrate; reactive** mineralization of single flexible polyelectrolyte mols. having frozen conformation on **solid substrates**)

L266 ANSWER 2 OF 3 HCA COPYRIGHT 2004 ACS on STN

135:200978 **Surface reactivity of Si**

nanowires. Sun, X. H.; Peng, H. Y.; Tang, Y. H.; Shi, W. S.; Wong, N. B.; Lee, C. S.; Lee, S. T.; Sham, T. K. (Center of Super-Diamond and Advanced Films, City University of Hong Kong, Hong Kong). Journal of Applied Physics, 89(11, Pt. 1), 6396-6399 (English) 2001. CODEN: JAPIAU. ISSN: 0021-8979. Publisher:

American Institute of Physics.

- AB The chem. reactivity of hydrogen-passivated **surface** of **Si nanowires** (SiNWs) towards the reductive deposition of Ag⁺ and Cu²⁺ from soln. is reported. SiNWs synthesized by laser ablation were used in the investigation. The surface properties of SiNWs after the removal of the surface oxide were studied. The **surface Si** of the SiNWs can readily reduce Ag⁺ and Cu²⁺ to metal aggregates of various morphologies on the SiNW surface at room temp. The reaction products were characterized with SEM, energy dispersive x-ray spectroscopy, high-resoln. TEM, EELS, and XPS. By varying the concn. of Ag⁺ in the soln., nanostructures of Ag with different shapes and sizes can be obtained. This approach for synthesis of metal nanostructures offers a potential method for the prepn. of desired metal catalysts.
- CC 66-4 (Surface Chemistry and Colloids)
- ST **silicon nanowire surface** redn silver copper nanostructure formation
- IT Nanostructures
(of silver and copper deposits formed by redn. at hydrogen-passivated Si **nanowires**)
- IT **Nanowires (metallic)**
(**surface reactivity** of hydrogen-passivated Si **nanowires** towards silver and copper ions from soln.)
- IT **Reactivity (chemical)**
(**surface;** of hydrogen-passivated Si **nanowires** towards silver and copper ions from soln.)
- IT Reduction
(surface; of silver and copper ions from soln. on hydrogen-passivated Si **nanowires**)
- IT 7440-22-4, Silver, properties 7440-50-8, Copper, properties
(nanostructures of silver and copper deposits formed by redn. at hydrogen-passivated Si **nanowires**)
- IT 1333-74-0, Hydrogen, processes
(**surface reactivity** of hydrogen-passivated Si **nanowires** towards silver and copper ions from soln.)
- IT 14701-21-4, Silver¹⁺, processes 15158-11-9, Copper ²⁺, processes
(**surface reactivity** of hydrogen-passivated Si **nanowires** towards silver and copper ions from soln.)
- IT 7440-21-3, Silicon, properties
(**surface reactivity** of hydrogen-passivated Si **nanowires** towards silver and copper ions from soln.)

L266 ANSWER 3 OF 3 HCA COPYRIGHT 2004 ACS on STN

135:36255 Method of processing carbon or BN **nanotubes** using a selective **solid state reaction**.

Zhang, Yuegang (NEC Corp., Japan). U.S. Pat. Appl. Publ. US 20010004471 A1 20010621, 9 pp. (English). CODEN: USXXCO.

APPLICATION: US 2000-739477 20001218. PRIORITY: JP 1999-359579
19991217.

AB The method comprises causing a selective **solid state reaction** between a selected part of a **nanotube** and a reactive substance by IR heating said reactive substance to have the selected part only become a reaction product, and sepg. the **nanotube** from the reaction product to define an **end** of the **nanotube**. The processed **nanotube** is a single-layer winded or a multilayer winded carbon or BN **nanotube**, and the reactive substance is Nb, Si, or a semiconductor. For example, the highest temp. of the **Nb substrate** may be 800-1000.degree. for 50-60 min to form reaction product of NbC, wherein a boundary between the NbC and the remaining single layer winded carbon **nanotubes** was aligned to the edge of the hole of the **Nb substrate**. The step of contacting the selected part of the **nanotube** with said reactive substance further comprises (a) dispersing said **nanotube** into an org. solvent (such as ethanol, 2-propanol and acetone) to form a dispersion liq., (b) applying said dispersion liq. onto a **surface** of said **reactive** substance, and (c) evapg. said org. solvent from said dispersion liq. to leave said **nanotube** on said reactive substance. Then, the **nanotube** is sepd. from the reaction product by rapidly cooling. The method is suitable for cutting the **nanotube** and for forming a **top** of the **nanotube**.

IC ICM B05D003-02

ICS H01L021-22

NCL 427372200

CC 57-8 (Ceramics)

Section cross-reference(s): 56

ST **nanotube** carbon boron nitride cutting

IT Heating

(IR; method of processing carbon or BN **nanotubes** using a selective **solid state reaction**)

IT **Solid state reaction**

(carbideization; method of processing carbon or BN **nanotubes** using a selective **solid state reaction**)

IT **Nanotubes**

(carbon, single-layer winded or multilayer winded; method of processing carbon or BN **nanotubes** using a selective **solid state reaction**)

IT Cutting

(**nanotube**; method of processing carbon or BN **nanotubes** using a selective **solid state reaction**)

IT Semiconductor materials

- (reactive substance; method of processing carbon or BN **nanotubes** using a selective **solid state reaction**)
- IT 64-17-5, Ethanol, processes 67-63-0, 2-Propanol, processes
67-64-1, Acetone, processes
(**nanotube** dispersion in; method of processing carbon or BN **nanotubes** using a selective **solid state reaction**)
- IT 12069-94-2, Niobium carbide (NbC)
(reaction product; method of processing carbon or BN **nanotubes** using a selective **solid state reaction**)
- IT 7440-03-1, Niobium, processes 7440-21-3, Silicon, processes
(reactive substance; method of processing carbon or BN **nanotubes** using a selective **solid state reaction**)
- IT 10043-11-5, Boron nitride, processes
(single-layer winded or multilayer winded **nanotubes**;
method of processing carbon or BN **nanotubes** using a
selective **solid state reaction**)

=> d 1267 1-22 cbib abs hitind

L267 ANSWER 1 OF 22 HCA COPYRIGHT 2004 ACS on STN

140:31852 Reactivity of surfaces and imaging with functional NSOM.
Knutson, Trevor L.; Guillaume, Francis; Lee, Woo-Jin; Alhoshan,
Mansour; Smyrl, William H. (Department of Chemical Engineering and
Materials Science, Corrosion Research Center, University of
Minnesota, Minneapolis, MN, 55455, USA). Electrochimica Acta,
48(20-22), 3229-3237 (English) 2003. CODEN: ELCAAV. ISSN:
0013-4686. Publisher: Elsevier Science B.V..

AB A review with refs. concerning reactivity of surfaces and imaging
with functional NSOM is presented. Practical interest in
high-resoln. microscopy relates to its use on reactive and reacting
heterogeneous surfaces. As the features of
interest approach the nanometer range in functional structures, the
microscopic techniques must approach the same resoln. in order to
monitor the progress of degrdn. processes and to assess the
reliability and lifetime of the features. Of interest here is the
modified near field optical scanning microscope for detg. concurrent
topog., fluorescence intensity and fluorescence spectroscopy on
reactive surfaces of aluminum alloy Al 2024. It is shown that
fluorescence spectroscopy on localized surface spots reveals aspects
of the chem. nature of the matrix surrounding the dye. The spatial
resoln. and spectral resoln. of the instrument will be discussed.

CC 66-0 (Surface Chemistry and Colloids)
Section cross-reference(s): 72, 73, 78

- IT Coating process
(electroless; **nanotubes** of Ni formed by electroless deposition on porous alumina template)
- IT Porous materials
(films; **nanotubes** of Ni formed by electroless deposition on porous alumina template)
- IT **Nanotubes**
(of Ni formed by electroless deposition on porous alumina template)
- IT Films
(porous; **nanotubes** of Ni formed by electroless deposition on porous alumina template)
- IT 7440-02-0P, Nickel, processes
(**nanotubes** of Ni formed by electroless deposition on porous alumina template)

L267 ANSWER 2 OF 22 HCA COPYRIGHT 2004 ACS on STN

139:339705 Carbon **nanofibers**, a new catalyst support for hydrazine decomposition. Vieira, Ricardo; Cuong, Pham-Huu; Keller, Nicolas; Ledoux, Marc J. (Laboratoire des Matériaux, Surface et Procédés pour la Catalyse, Université Louis Pasteur, Strasbourg, 67087, Fr.). Quimica Nova, 26(5), 665-669 (Portuguese) 2003. CODEN: QUNODK. ISSN: 0100-4042. Publisher: Sociedade Brasileira de Quimica.

AB Today satellites propulsion is based on the use of monopropellant and/or bipropellant chem. systems. The maneuvering of satellite is based on the hydrazine decompn. micropropulsors catalyzed by metallic iridium supported on .gamma.-alumina. This **reaction** is a **surface reaction** and is strongly exothermic and implies that the operation of the micropropulsor is controlled by the mass and heat diffusions. For this reason and for the fact that the propulsor operation is frequently in pulsed regime, the catalyst should support high pressure and temp. variations within a short time period. The performance and the durability of the com. catalyst are jeopardized by the low thermal cond. of the alumina. The low thermal cond. of the alumina support restricts the heat diffusion and leads to the formation of hot spots on the catalyst **surface** causing the **metal** sintering and/or fractures of the support, resulting in loss of the activity and catalyst destruction. This work presents the synthesis and characterization of new carbon composite support for the active element iridium, in substitution of the com. catalysts alumina based support. These supports are constituted of carbon **nanofibers** (30-40 nm diam.) supported on a macroscopic carbon felt. These materials present high thermal cond. and mech. resistance, as well as the easiness to be shaped with different macroscopic shapes. The mech. stability and the performance of the iridium supported on the carbon composite

- support, evaluated in a lab. scale test in hydrazine decompn. reaction, are superior compared to the com. catalyst.
- CC 50-7 (Propellants and Explosives)
Section cross-reference(s): 67
- ST carbon **nanofiber** iridium catalyst support hydrazine decompn satellite propulsion
- IT Catalyst supports
Propulsion
Satellites
Thermal decomposition
(carbon **nanofibers** as iridium catalyst support for hydrazine decompn. in satellite propulsion)
- IT Carbon fibers, uses
(carbon **nanofibers** as iridium catalyst support for hydrazine decompn. in satellite propulsion)
- IT **Nanofibers**
(carbon; carbon **nanofibers** as iridium catalyst support for hydrazine decompn. in satellite propulsion)
- IT 7439-88-5, Iridium, uses
(carbon **nanofibers** as iridium catalyst support for hydrazine decompn. in satellite propulsion)
- IT 302-01-2, Hydrazine, uses
(carbon **nanofibers** as iridium catalyst support for hydrazine decompn. in satellite propulsion)
- L267 ANSWER 3 OF 22 HCA COPYRIGHT 2004 ACS on STN
138:407517 Composites based on carbon **nanotubes** deposited on an activated support for application in catalysis. Pham, Huu Cuong; Vieira, Ricardo; Ledoux, Marc J.; Charbonniere, Loic; Ziessel, Raymond (Sicat, Fr.). Fr. Demande FR 2832649 A1 20030530, 28 pp. (French). CODEN: FRXXBL. APPLICATION: FR 2001-15178 20011123.
- AB The invention relates to a composite comprising an activated support and **nanotubes** or **nanofibers** of carbon formed by vapor deposition, and the use of these composites as catalyst or catalyst support of chem. reactions in gaseous medium or liq., in particular in the chem. or petrochem. industry and depollution of exhaust fumes of motor vehicles, and satellite propulsion.
- IC ICM B01J032-00
ICS B01J035-00; B01J037-025; H01M004-36; B64G001-40; B01J021-18
- CC 67-1 (Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms)
Section cross-reference(s): 51, 59, 75
- ST composite carbon **nanotube** deposited activated support catalysis; petrochem catalysis composite carbon **nanotube** deposited activated support catalysis; emission control catalysis composite carbon **nanotube** activated support catalysis; engine exhaust catalysis composite carbon **nanotube** activated support catalysis; satellite propulsion catalysis

- composite carbon **nanotube** activated support catalysis
- IT Acylation catalysts
 - (Friedel-Crafts; composites based on carbon **nanotubes** deposited on activated support for application in catalysis)
- IT **Nanofibers**
 - Nanotubes**
 - (carbon; composites based on carbon **nanotubes** deposited on activated support for application in catalysis)
- IT Vapor deposition process
 - (chem.; composites based on carbon **nanotubes** deposited on activated support for application in catalysis)
- IT Catalysis
 - Catalyst supports
 - Catalysts
 - Composites
 - Exhaust gases (engine)
 - Friedel-Crafts **reaction** catalysts
 - (composites **based** on carbon **nanotubes** deposited on activated support for application in catalysis)
- IT Oxides (inorganic), uses
 - Transition **metals**, uses
 - (composites **based** on carbon **nanotubes** deposited on activated support for application in catalysis)
- IT Electrodes
 - (composites based on carbon **nanotubes** deposited on activated support for application in catalysis in relation to)
- IT Air pollution
 - (control; composites based on carbon **nanotubes** deposited on activated support for application in catalysis)
- IT Reduction catalysts
 - (electrochem., for CO₂; composites based on carbon **nanotubes** deposited on activated support for application in catalysis in relation to)
- IT Oxidation catalysts
 - (for CO; composites based on carbon **nanotubes** deposited on activated support for application in catalysis)
- IT Decomposition catalysts
 - (for hydrazine and derivs. and oxygenated water; composites based on carbon **nanotubes** deposited on activated support for application in catalysis)
- IT Satellites
 - (propulsion of; composites based on carbon **nanotubes** deposited on activated support for application in catalysis in relation to)
- IT 100-66-3, Anisole, reactions
 - (acylation by benzoyl chloride of; composites based on carbon **nanotubes** deposited on activated support for application in catalysis)

- IT 98-88-4, Benzoyl chloride
(acylation of anisole by; composites based on carbon **nanotubes** deposited on activated support for application in catalysis)
- IT 93-99-2P
(composites based on carbon **nanotubes** deposited on activated support for application in catalysis)
- IT 1302-88-1, Cordierite 1314-23-4, Zirconia, uses 1344-28-1, Alumina, uses 7439-89-6, Iron, uses 7440-02-0, Nickel, uses 7440-48-4, Cobalt, uses 7440-50-8, Copper, uses 7631-86-9, Silica, uses 13463-67-7, Titania, uses
(composites based on carbon **nanotubes** deposited on activated support for application in catalysis)
- IT 611-94-9P 7664-41-7P, Ammonia, preparation
(composites based on carbon **nanotubes** deposited on activated support for application in catalysis)
- IT 302-01-2, Hydrazine, reactions 302-01-2D, Hydrazine, derivs.
(decompn. of; composites based on carbon **nanotubes** deposited on activated support for application in catalysis)
- IT 124-38-9, Carbon dioxide, reactions
(electroreductn. of; composites based on carbon **nanotubes** deposited on activated support for application in catalysis)
- IT 7782-44-7, Oxygen, reactions
(in water, decompn. of; composites based on carbon **nanotubes** deposited on activated support for application in catalysis)
- IT 7440-44-0, Carbon, uses
(**nanotubes** or **nanofibers**; composites based on carbon **nanotubes** deposited on activated support for application in catalysis)
- IT 630-08-0, Carbon monoxide, reactions
(oxidn. of; composites based on carbon **nanotubes** deposited on activated support for application in catalysis)
- IT 7732-18-5, Water, reactions
(oxygenated, decompn. of; composites based on carbon **nanotubes** deposited on activated support for application in catalysis)

L267 ANSWER 4 OF 22 HCA COPYRIGHT 2004 ACS on STN

138:329644 Nanoscale fabrication using single-ion impacts. Millar, Victoria; Pakes, Chris I.; Cimmino, Alberto; Brett, David; Jamieson, David N.; Prawer, Steven; Yang, Changyi J.; Rout, B.; McKinnon, Rita P.; Dzurak, Andrew S.; Clark, Robert G. (Centre for Quantum Computer Technology, School of Physics, University of Melbourne, Victoria, 3010, Australia). Smart Materials and Structures, 11(5), 686-690 (English) 2002. CODEN: SMSTER. ISSN: 0964-1726. Publisher: Institute of Physics Publishing.

AB A technique for fabrication of nanoscale structures was developed

which is based on formation of localized chem. modifications in poly(Me methacrylate) (PMMA) resist by implantation of single 31P ions. The implantation of 4 MeV He ions through a thin layer of PMMA into an underlying silicon substrate causes latent damage in the resist. Upon development of the resist, clearly defined etched holes of 30 nm diam. were obsd. using an at. force microscope with a carbon **nanotube** SPM [scanning probe microscopy] probe in intermittent-contact mode. Used to register the passage of an ion, the technique is useful in verification of impact sites in an ion-beam modification process operating at the single-ion level. The hole in the PMMA layer can be used to produce self-aligned structures in which surface features are fabricated directly above regions of an underlying substrate that are locally doped by the implanted ion. Single-ion resists can also be used to produce a **solid-state** quantum computer based arrays of 31P atoms (which act as qubits) embedded with nanoscale precision in a silicon matrix. Subsequent metalization of the latent damage may allow the fabrication of self-aligned metal gates above buried phosphorus atoms usable in electronics.

CC 76-3 (Electric Phenomena)

Section cross-reference(s): 38

ST polymethyl methacrylate resist ion implantation nanoscale feature underlying substrate; carbon **nanotube** probe atomic force microscopy resist ion implantation; quantum computer fabrication single phosphorus ion impact silicon

IT **Nanotubes**

(carbon, AFM imaging probe; nanoscale fabrication using single-ion impacts through PMMA resist into silicon substrate forming quantum arrays with 31P qubits)

L267 ANSWER 5 OF 22 HCA COPYRIGHT 2004 ACS on STN

138:157436 **Nanotube** growth during annealing of mechanically milled boron. Fitz Gerald, J. D.; Chen, Y.; Conway, M. J. (Research School of Earth Sciences, Australian National University, ACT 0200, Australia). Applied Physics A: Materials Science & Processing, 76(1), 107-110 (English) 2003. CODEN: APAMFC. ISSN: 0947-8396. Publisher: Springer-Verlag.

AB Boron powder, finely ground in a tungsten carbide ball mill in ammonia atm., was annealed at 1200.degree. in flowing nitrogen to produce small quantities of cylindrical BN **nanotubes**, both as isolated individuals and grouped into ropes. Thick-walled conical BN tubes are abundant in specimens annealed for longer times, and their growth was catalyzed once WC debris was converted into W metal particles. Some catalytic effect of small W nanoparticles could be necessary for **nanotube** formation, though no tip particles were imaged here. Given the low temp. of mech. milling and annealing, BN growth must involve **surface** diffusion and **solid-state** reconfiguration. It

could be possible to engineer desirable phys. and chem. properties by exploiting the variation in cylindrical vs. conical BN structures as a function of annealing time.

CC 57-2 (Ceramics)

ST boron nitride **nanotube** mech milling annealing
microstructure tungsten catalyst

IT Annealing
Ball milling
Microstructure

Nanotubes

(**nanotube** growth during annealing of mech. milled boron in the presence of tungsten)

IT 7440-33-7, Tungsten, uses
(nanoparticles, catalyst; **nanotube** growth during annealing of mech. milled boron in the presence of tungsten)

IT 10043-11-5P, Boron nitride (BN), preparation
(**nanotubes**; **nanotube** growth during annealing of mech. milled boron in the presence of tungsten)

L267 ANSWER 6 OF 22 HCA COPYRIGHT 2004 ACS on STN

138:56655 Functionalization of Carbon **Nanotubes** with Polystyrene. Hill, Darron E.; Lin, Yi; Rao, Apparao M.; Allard, Lawrence F.; Sun, Ya-Ping (Department of Chemistry and Center for Advanced Engineering Fibers and Films, Howard L. Hunter Chemistry Laboratory, Clemson University, Clemson, SC, 29634-0973, USA). *Macromolecules*, 35(25), 9466-9471 (English) 2002. CODEN: MAMOBX. ISSN: 0024-9297. Publisher: American Chemical Society.

AB Single-walled and multiple-walled carbon **nanotubes** were functionalized with a polystyrene copolymer, poly(styrene-co-p-(4-(4'-vinylphenyl)-3-oxabutanol)). The functionalization reaction conditions were designed for the esterification of the **nanotube**-bound carboxylic acids. The polymer-attached carbon **nanotubes** are sol. in common org. solvents, making it possible to characterize the samples using not only **solid-state** but also soln.-based techniques. The soly. has also allowed an intimate mixing of the functionalized carbon **nanotubes** with polystyrene. Results from the characterization of the functionalized carbon **nanotubes**, including the chem. and thermal defunctionalizations of the sol. samples, and the fabrication of polystyrene-carbon **nanotube** composite thin films using a wet-casting method are presented and discussed.

CC 37-3 (Plastics Manufacture and Processing)
Section cross-reference(s): 57

ST carbon **nanotube** modification polystyrene
vinylphenyloxabutanol polymer; morphol carbon **nanotube**
polystyrene modification

IT **Nanotubes**

(carbon; functionalization of carbon **nanotubes** with polystyrene)

IT Polymer morphology
UV and visible spectra
(of carbon **nanotubes** functionalized with polystyrene)

IT 7719-09-7, Thionyl chloride
(for functioning carbon **nanotube**; in prepn. of carbon **nanotubes** with polystyrene)

IT 107-21-1, Ethylene glycol, reactions 1592-20-7,
p-Chloromethylstyrene
(in prepn. of carbon **nanotubes** with polystyrene)

IT 91970-02-4P
(in prepn. of carbon **nanotubes** with polystyrene)

IT 479396-04-8P
(on carbon **nanotube**; functionalization of carbon **nanotubes** with styrene copolymer)

L267 ANSWER 7 OF 22 HCA COPYRIGHT 2004 ACS on STN

138:25875 Substrates with modified carbon surfaces. Burrington, James D.; Davis, Kirk E.; Jolley, Scott T.; Kornbrekke, Ralph E.; Piolet, Joseph W.; Pike, Philip W.; Sowerby, Roger L. (The Lubrizol Corporation, USA). PCT Int. Appl. WO 2002098991 A1 20021212, 22 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW; RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2002-US16941 20020530. PRIORITY: US 2001-PV295316 20010601.

AB A process for functionalizing a carbon surface and the product thereof is disclosed. The first reactant used contains one or more electron withdrawing groups that thereafter can be reacted with other compds. The reaction product has enhanced dispersibility, interaction with other media, or other utilitarian uses, e.g. a **reactive surface**. The reaction product is then incorporated into an elastomeric or thermoplastic compn.; it can be dispersed in a liq. media such as an ink, coating, or lubricant; or it can be used as a solid in applications such as a filtering media.

IC ICM C09C001-56
ICS C09C001-46; C09C001-44; C02F001-28; C09D007-12; C09D011-00;
C09D011-02

CC 42-10 (Coatings, Inks, and Related Products)
Section cross-reference(s): 37, 52

ST **solid carbon surface** modification electron
withdrawing compd

IT **Nanotubes**

- (carbon, surface-modified; substrates with modified carbon surfaces)
- IT Polyethers, uses
(reaction products with **solid** carbon;
substrates with modified carbon surfaces)
- IT 79-10-7D, Acrylic acid, reaction products with **solid** carbon 79-41-4D, Methacrylic acid, reaction products with **solid** carbon 97-65-4D, Itaconic acid, reaction products with **solid** carbon 107-15-3D, Ethylenediamine, reaction products with **solid** carbon 108-31-6D, Maleic anhydride, reaction products with **solid** carbon 110-16-7D, Maleic acid, Diels Alder adducts with polyenes, reaction products with **solid** carbon 298-12-4D, Glyoxylic acid, reaction products with **solid** carbon 922-68-9D, Methyl glyoxylate, reaction products with **solid** carbon 1310-58-3D, Potassium hydroxide, reaction products with **solid** carbon
(**substrates** with modified carbon surfaces)
- L267 ANSWER 8 OF 22 HCA COPYRIGHT 2004 ACS on STN
137:318265 Method of forming carbon **nanotubes** and apparatus therefor. Jayatissa, Ahalapitiya H. (USA). U.S. Pat. Appl. Publ. US 2002150684 A1 20021017, 5 pp. (English). CODEN: USXXCO. APPLICATION: US 2001-835757 20010416.
- AB C **nanotubes** are formed on a substrate by providing a coiled filament in a CVD chamber, supporting a substrate having a catalytic coating provided thereon inside the coiled filament, evacuating air, if present, from the chamber, heating the filament and applying a bias voltage between the filament and the **substrate**, introducing a **reactant** gas into the chamber, and pyrolyzing the reactant gas to deposit the C **nanotubes** on the catalytic coating. The substrate can be as a rod or fiber and the C **nanotubes** can be deposited in a radially extending cluster on the substrate. The present invention also contemplates an app. for carrying out the inventive method.
- IC ICM C23C016-00
ICS C23C014-00
- NCL 427314000
- CC 75-1 (Crystallography and Liquid Crystals)
Section cross-reference(s): 57
- ST carbon **nanotube** growth CVD
- IT **Nanotubes**
(carbon; method and app. of forming carbon **nanotubes** on substrate)
- IT Vapor deposition process
(chem.; method and app. of forming carbon **nanotubes** on substrate)
- IT Vapor deposition apparatus
(method and app. of forming carbon **nanotubes** on

- substrate)
- IT Vapor deposition process
(phys.; method and app. of forming carbon **nanotubes** on substrate)
- IT Ceramics
(substrate; method and app. of forming carbon **nanotubes** on substrate)
- IT Fibers
Metals, uses
(**substrate**; method and app. of forming carbon **nanotubes** on substrate)
- IT Chromium alloy, base
Cobalt alloy, base
Iron alloy, base
Nickel alloy, base
(catalytic coating; catalytic **metal** coating on **substrate** to aid growth of carbon **nanotubes** on substrate)
- IT 7439-89-6, Iron, uses 7440-02-0, Nickel, uses 7440-47-3, Chromium, uses 7440-48-4, Cobalt, uses
(catalytic coating; catalytic **metal** coating on **substrate** to aid growth of carbon **nanotubes** on substrate)
- IT 7440-44-0, Carbon, processes
(**nanotubes**; method and app. of forming carbon **nanotubes** on carbon substrate)
- IT 74-85-1, Ethylene, processes 74-86-2, Acetylene, processes
(reactant gas; method and app. of forming carbon **nanotubes** on substrate)
- IT 7664-41-7, Ammonia, uses
(used to activate catalytic **metal** coating on **substrate** to aid growth of carbon **nanotubes** on substrate)

L267 ANSWER 9 OF 22 HCA COPYRIGHT 2004 ACS on STN

137:300469 Simulation of chemical reaction equilibria and kinetics in heterogeneous carbon micropores. Turner, C. Heath; Brennan, John K.; Pikunic, Jorge; Gubbins, Keith E. (Department of Chemical Engineering, North Carolina State University, Raleigh, NC, 27695-7905, USA). Applied Surface Science, 196(1-4), 366-374 (English) 2002. CODEN: ASUSEE. ISSN: 0169-4332. Publisher: Elsevier Science B.V..

AB We present a simulation study which shows how the equil. yield and kinetics of chem. reactions can be enhanced by tailoring the structure and surface chem. of the catalyst support material. Equil. results are presented for the ammonia synthesis reaction, $N_2+3H_2 \rightleftharpoons 2NH_3$, occurring within various carbon supports, representing a range of chem. and phys. **surface**

heterogeneity. Using a simulation technique known as Reactive Monte Carlo (RxMC), we find that surface activation and pore width are primary factors in detg. the conversion of the ammonia synthesis reaction while effects of surface corrugation are small. We probe the kinetic effects of phys. confinement within microporous carbons by studying the bimol. hydrogen iodide decompn. reaction, $2\text{HI} \rightarrow \text{H}_2 + \text{I}_2$, in carbon slit-pores and **nanotubes**. The rate const. of this reaction is measured by combining the quasi-equil. hypothesis of transition-state theory (TST) with the RxMC simulation technique. The kinetic simulations represent a new method for probing reaction kinetics in non-ideal environments and show accurate results when applied to the hydrogen iodide decompn. reaction.

CC 67-3 (Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms)

Section cross-reference(s): 65, 68

IT **Nanotubes**

(carbon; simulation of chem. reaction equil. and kinetics in heterogeneous carbon micropores)

L267 ANSWER 10 OF 22 HCA COPYRIGHT 2004 ACS on STN

136:287461 Nanoscale fabrication using single-ion impacts. Millar, Victoria; Pakes, Chris I.; Cimmino, Alberto; Brett, David; Jamieson, David N.; Prawer, Steven D.; Yang, Changyi; Rout, Bidhu; McKinnon, Rita P.; Dzurak, Andrew S.; Clark, Robert G. (Centre for Quantum Computer Technology, Australia). Proceedings of SPIE-The International Society for Optical Engineering, 4590(BioMEMS and Smart Nanostructures), 173-178 (English) 2001. CODEN: PSISDG. ISSN: 0277-786X. Publisher: SPIE-The International Society for Optical Engineering.

AB We describe a novel technique for the fabrication of nanoscale structures, based on the development of localized chem. modification caused in a PMMA resist by the implantation of single ions. The implantation of 2 MeV He ions through a thin layer of PMMA into an underlying silicon substrate causes latent damage in the resist. On development of the resist we demonstrate the formation within the PMMA layer of clearly defined etched holes, of typical diam. 30 nm, obsd. using an at. force microscope employing a carbon **nanotube** SPM probe in intermittent-contact mode. This technique has significant potential applications. Used purely to register the passage of an ion, it may be a useful verification of the impact sites in an ion-beam modification process operating at the single-ion level. Furthermore, making use of the hole in the PMMA layer to perform subsequent fabrication steps, it may be applied to the fabrication of self-aligned structures in which surface features are fabricated directly above regions of an underlying substrate that are locally doped by the implanted ion. Our primary interest in single-ion resists relates to the

development of a **solid-state** quantum computer based on an array of ^{31}P atoms (which act as qubits) embedded with nanoscale precision in a silicon matrix. One proposal for the fabrication of such an array is by phosphorous-ion implantation. A single-ion resist would permit an accurate verification of ^{31}P implantation sites. Subsequent metalization of the latent damage may allow the fabrication of self-aligned metal gates above buried phosphorous atoms.

CC 76-14 (Electric Phenomena)
Section cross-reference(s): 38

L267 ANSWER 11 OF 22 HCA COPYRIGHT 2004 ACS on STN

136:56000 Composite combining monolayer or multilayer of zeolite molecular sieve or its analogue onto a substrate and preparation thereof. Yoon, Kyung Byung; Ha, Kwang; Lee, Yunjo; Park, Yongsu; Chun, Yusung; Lee, Goosoo; Choi, Soyeun; Oh, Kyoungsun (S. Korea). PCT Int. Appl. WO 2001096106 A1 20011220, 69 pp. DESIGNATED STATES: W: CN, JP, US; RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE. (English). CODEN: PIXXD2. APPLICATION: WO 2000-KR1002 20000902. PRIORITY: KR 2000-19667 20000414.

AB The present invention relates to a zeolite-substrate composite having a zeolite monolayer or multilayer bound on the surface of the substrate, comprising (i) a substrate selected from a group consisting of a substrate having surface hydroxyl groups, a **metal substrate** capable of **reacting** with thiol groups, and a polymeric materials having reactive functional groups at its main or side chain, (ii) mol. sieve particles selected from porous oxides or sulfides having surface hydroxyl groups, and (iii) a linker derived from a linking compd. having at least 2 functional groups at both terminal ends, of which one is chem. bonded to said substrate and the other is chem. bonded to said zeolite; wherein said chem. bonding of linker to the substrate and zeolite or its analog is achieved by any of covalent bonds, ionic bonds, and/or coordination bonds, and a method of prepg. the same.

IC ICM B32B027-00

CC 49-4 (Industrial Inorganic Chemicals)

IT **Nanotubes**

(carbon; composite combining substrate with monolayer or multilayer of zeolite mol. sieve or analog using linker of)

L267 ANSWER 12 OF 22 HCA COPYRIGHT 2004 ACS on STN

136:43526 Influence of chemical and physical **surface heterogeneity** on chemical reaction equilibria in carbon micropores. Turner, C. Heath; Pikunic, Jorge; Gubbins, Keith E. (113 Riddick Labs, North Carolina State University, Raleigh, NC, 27695-7905, USA). Molecular Physics, 99(24), 1991-2001 (English) 2001. CODEN: MOPHAM. ISSN: 0026-8976. Publisher: Taylor & Francis Ltd..

- AB Recent simulation results are presented for the equil. yield of the ammonia synthesis reaction in various model microporous carbons. It is found that the reaction equil. within the micropores is affected by many factors, including pore size, pore shape, connectivity, surface roughness, and surface chem. activation. In order to probe these effects, reactive Monte Carlo simulations of the reaction were performed in several microporous carbon models: smooth slit-shaped carbon pores, a realistic carbon model generated from exptl. diffraction data, single-walled carbon **nanotubes**, and smooth slit-shaped pores activated by carboxyl surface groups. The simulations show that the ammonia conversion is most sensitive to the carbon pore width and to the amt. of surface chem. activation. Effects of surface corrugation and pore connectivity on the equil. reaction yield are minimal.
- CC 67-3 (Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms)
Section cross-reference(s): 65, 66, 68
- ST chem phys **surface heterogeneity** reaction equil
carbon micropore catalyst; ammonia synthesis carbon micropore catalyst chem phys **surface heterogeneity**
- IT Simulation and Modeling, physicochemical
(Monte Carlo; influence of chem. and phys. **surface heterogeneity** on chem. reaction equil. in carbon micropores)
- IT **Nanotubes**
(carbon; influence of chem. and phys. **surface heterogeneity** on chem. reaction equil. in carbon micropores)
- IT Catalysts
Equilibrium
Pore size
Surface structure
(influence of chem. and phys. **surface heterogeneity** on chem. reaction equil. in carbon micropores)
- IT Pore
(micropore; influence of chem. and phys. **surface heterogeneity** on chem. reaction equil. in carbon micropores)
- IT 7440-44-0, Carbon, uses
(influence of chem. and phys. **surface heterogeneity** on chem. reaction equil. in carbon micropores)
- IT 7664-41-7P, Ammonia, preparation
(influence of chem. and phys. **surface heterogeneity** on chem. reaction equil. in carbon micropores)

L267 ANSWER 13 OF 22 HCA COPYRIGHT 2004 ACS on STN

135:264437 A soft lithographic approach to the fabrication of single crystalline silicon nanostructures with well-defined dimensions and shapes. Yin, Yadong; Gates, Byron; Xia, Younan (Department of Materials Science and Engineering, University of Washington, Seattle, WA, 98195, USA). Materials Research Society Symposium Proceedings, 636(Nonlithographic and Lithographic Methods of Nanofabrication: From Ultralarge-Scale Integration to Photonics to Molecular Electronics), D4.2/1-D4.2/6 (English) 2001. CODEN: MRSPDH. ISSN: 0272-9172. Publisher: Materials Research Society.

AB A procedure was developed for large-scale fabrication of nanometer-sized structures of single cryst. silicon with well-defined dimensions and shapes. Near-field optical lithog. was used to define the nanostructures in a thin film of pos.-tone photoresist with an elastomeric phase mask. The nanostructures were then transferred into the underlying silicon-on-insulator (SOI) **substrate** through a **reactive** ion etching (RIE) process. With this method, the authors can routinely generate silicon nanostructures .apprx.130 nm in lateral dimension. They can be supported on the **surface** of a **solid substrate** as a patterned array, or released into a freestanding form. The lateral dimension of these silicon structures could be further reduced to as small as .apprx.40 nm using stress-limited oxidn. at elevated temps. The flexibility of this approach was demonstrated by fabricating nanoscale wires, rods, rings, and interconnected triangles of silicon. Using a two-step exposure method, the silicon **nanowires** can be precisely "cut" into silicon nanorods with specific lengths.

CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)
Section cross-reference(s): 76

L267 ANSWER 14 OF 22 HCA COPYRIGHT 2004 ACS on STN

135:249859 Strain-induced electronic property heterogeneity of a carbon **nanotube**. Tekleab, D.; Carroll, D. L.; Samsonidze, G. G.; Yakobson, B. I. (Department of Physics and Astronomy, Kinard Laboratory of Physics, Clemson University, Clemson, SC, 29634, USA). Physical Review B: Condensed Matter and Materials Physics, 64(3), 035419/1-035419/5 (English) 2001. CODEN: PRBMDO. ISSN: 0163-1829. Publisher: American Physical Society.

AB We have studied the effect of strain on the electronic properties of multiwall carbon **nanotubes** using scanning tunneling microscopy and spectroscopy. While small elastic strain causes no change of the electronic properties of the **nanotubes**, tubes under large strain by lying over an intergrain boundary of the Au **substrate** show drastic electronic **heterogeneity**. The obsd. variation in local electronic property is explained in terms of the mech. relaxation of the outer most layer of the tube.

This provides first evidence of the effect of mech. modification on local electronic structure of a carbon **nanotube**.

CC 76-1 (Electric Phenomena)

Section cross-reference(s): 65

ST carbon **nanotube** strain electronic structure

IT **Nanotubes**

(carbon; strain-induced electronic property heterogeneity of a carbon **nanotube**)

IT Density of states

(local; strain-induced electronic property heterogeneity of a carbon **nanotube**)

IT Band gap

Electric current-potential relationship

Electronic structure

Grain boundaries

Mechanical relaxation

Scanning tunneling microscopy

Strain

Tunneling conductance

(strain-induced electronic property heterogeneity of a carbon **nanotube**)

IT 7440-44-0D, Carbon, **nanotubes**, properties

(strain-induced electronic property heterogeneity of a carbon **nanotube**)

IT 7440-57-5, Gold, processes

(substrate; strain-induced electronic property heterogeneity of a carbon **nanotube**)

L267 ANSWER 15 OF 22 HCA COPYRIGHT 2004 ACS on STN

135:200772 HRTEM **surface** characterization of nanoscale

solid-state materials. Zhou, W.; Ma, X. C.; Yuan, Z. Y.; Wang, E. G. (School of Chemistry, University of St. Andrews, St. Andrews, KY16 9ST, UK). Surface and Interface Analysis, 32(1), 236-239 (English) 2001. CODEN: SIANDQ. ISSN: 0142-2421. Publisher: John Wiley & Sons Ltd..

AB A review with 22 refs. Surface structures of various nanoscale materials were studied in profile by high-resoln. transmission electron microscopy. These materials include C **nanofibers** contg. polymd. carbon nanobells, boron carbonitride **nanofibers** with a cactus-like surface structure, C **nanotubes** with polymer coating, mesoporous mol. sieves with a paintbrush-like surface and some nanoparticle specimens with interesting surfaces. The formation mechanisms of the surface structures and the surface-related properties of the materials also are discussed.

CC 66-0 (Surface Chemistry and Colloids)

IT Nanoparticles

Surface structure

- (HRTEM **surface** characterization of nanoscale **solid-state** materials)
- IT Carbon fibers, properties
Zeolite MCM-41
(HRTEM **surface** characterization of nanoscale **solid-state** materials)
- IT **Nanotubes**
(carbon; HRTEM **surface** characterization of nanoscale **solid-state** materials)
- IT Transmission electron microscopy
(high-resoln.; HRTEM **surface** characterization of nanoscale **solid-state** materials)
- IT 12656-55-2, boron carbonitride
(HRTEM **surface** characterization of nanoscale **solid-state** materials)

L267 ANSWER 16 OF 22 HCA COPYRIGHT 2004 ACS on STN

134:45814 Manufacture of aligned, conductive substance filled carbon **nanotubes** on a substrate. Gao, Yufei; Liu, Jun (Battelle Memorial Institute, USA). PCT Int. Appl. WO 2000076912 A2 20001221, 19 pp. DESIGNATED STATES: W: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG. (English). CODEN: PIXXD2. APPLICATION: WO 2000-US16783 20000613. PRIORITY: US 1999-333876 19990614.

AB The method provides a densely packed carbon **nanotube** growth perpendicular to the substrate where each **nanotube** is in contact with at least one nearest-neighbor **nanotube** and the hollow core of the **nanotubes** contains conductive filler comprising C and Ti, V, and/or Ta. The **nanotubes** have the length of 1-2 .mu.m, the outside diam. of 50-400 nm and the inside diam. of 10-100 nm. The substrate is a conductive material - Ti, TiC, V, or Ta coated with a growth catalyst - Fe or/and FeO, and the conductive filler can be single crystals of carbides formed by a **solid state** reaction between the **substrate** material and the growth catalyst. The manuf. includes the steps of (1) depositing a growth catalyst onto the conductive substrate, (2) creating vacuum within the vessel which contains the prepd. substrate, (3) flowing H₂/inert (e.g. Ar) gas within the vessel to increase and maintain the pressure within the vessel, (4) increasing the temp. of the prepd. substrate and changing the H₂/Ar gas to the flow of ethylene gas. Addnl., varying the d. and sepn. of the catalyst particles on the conductive substrate can be used to

control the diam. of the **nanotubes**.

IC ICM C01B

CC 57-8 (Ceramics)

Section cross-reference(s): 56

ST carbon **nanotube** conductive filler substrate growth

IT **Nanotubes**

(carbon; manuf. of aligned, conductive substance filled carbon **nanotubes** on substrate)

IT Solid state reaction

(manuf. of aligned, conductive substance filled carbon **nanotubes** on substrate by)

IT 1345-25-1, Ferrous oxide, processes 7439-89-6, Iron, processes
(growth catalyst; manuf. of aligned, conductive substance filled carbon **nanotubes** on substrate)

IT 7440-44-0, Carbon, processes

(**nanotube** filler; manuf. of aligned, conductive substance filled carbon **nanotubes** on substrate)

IT 74-85-1, Ethylene, processes

(precursor; precursor in manuf. of aligned, conductive substance filled carbon **nanotubes** on substrate)

IT 7440-25-7, Tantalum, processes 7440-32-6, Titanium, processes
7440-62-2, Vanadium, processes

(substrate/**nanotube** filler; manuf. of aligned, conductive substance filled carbon **nanotubes** on substrate)

L267 ANSWER 17 OF 22 HCA COPYRIGHT 2004 ACS on STN

134:30909 Substrate-supported aligned carbon **nanotube** films.

Mau, Albert; Dai, Li-Ming; Shaoming, Huang (Commonwealth Scientific and Industrial Research Organisation, Australia). PCT Int. Appl. WO 2000073204 A1 20001207, 19 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG. (English). CODEN: PIXXD2. APPLICATION: WO 2000-AU550 20000525. PRIORITY: AU 1999-650 19990528.

AB Substrate-supported aligned carbon **nanotube** films are
prepd. by synthesizing a layer of aligned carbon **nanotubes**
on a substrate capable of supporting **nanotube** growth,
applying a layer of a second substrate to a top surface of the
aligned carbon **nanotube** layer, and peeling off the
substrate capable of supporting **nanotube** growth, to
provide an aligned carbon **nanotube** film supported on the
second substrate.

IC C01B031-02; D01F009-12; D01F009-127

- CC 49-1 (Industrial Inorganic Chemicals)
Section cross-reference(s): 57, 67
- ST carbon **nanotube** aligned film substrate supported
- IT **Nanotubes**
(carbon fibers, fibrils; substrate-supported aligned carbon **nanotube** films)
- IT **Nanotubes**
(carbon; substrate-supported aligned carbon **nanotube** films)
- IT Vapor deposition process
(chem.; substrate-supported aligned carbon **nanotube** films)
- IT Carbon fibers, preparation
(**nanotube**, fibrils; substrate-supported aligned carbon **nanotube** films)
- IT Ceramics
Thermal decomposition catalysts
(substrate-supported aligned carbon **nanotube** films)
- IT Transition **metals**, uses
(**substrate**-supported aligned carbon **nanotube** films)
- IT Alkanes, **reactions**
Alkenes, **reactions**
Alkynes
Aromatic hydrocarbons, **reactions**
(**substrate**-supported aligned carbon **nanotube** films)
- IT Glass, uses
Mica-group minerals, uses
Polymers, uses
(substrate-supported aligned carbon **nanotube** films)
- IT Organometallic compounds
(transition **metal**; **substrate**-supported aligned carbon **nanotube** films)
- IT 3317-67-7, Cobalt(II) phthalocyanine 14055-02-8, Nickel(II) phthalocyanine
(substrate-supported aligned carbon **nanotube** films)
- IT 102-54-5, Ferrocene 132-16-1, Iron(II) phthalocyanine 1271-28-9, Nickel, dicyclopentadienyl-
(substrate-supported aligned carbon **nanotube** films)
- IT 7429-90-5, Aluminum, uses 7439-89-6, Iron, uses 7439-96-5, Manganese, uses 7440-02-0, Nickel, uses 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-47-3, Chromium, uses 7440-48-4, Cobalt, uses 7440-50-8, Copper, uses 7440-57-5, Gold, uses
(substrate-supported aligned carbon **nanotube** films)
- IT 71-43-2, Benzene, **reactions** 74-82-8, Methane, **reactions** 74-86-2, Acetylene, **reactions**

- (**substrate**-supported aligned carbon **nanotube** films)
- IT 1302-81-4, Aluminum sulfide 1303-00-0, Gallium arsenide, uses
1309-48-4, Magnesia, uses 1344-09-8, Waterglass 1344-28-1,
Alumina, uses 7631-86-9, Silica, uses 7782-42-5, Graphite, uses
13463-67-7, Titania, uses 14808-60-7, Quartz, uses 22831-42-1,
Aluminum arsenide 50926-11-9, Indium tin oxide 53238-24-7,
Gallium sulfide
(**substrate**-supported aligned carbon **nanotube** films)
- IT 9004-34-6, Cellulose, uses
(tape; **substrate**-supported aligned carbon **nanotube** films)
- L267 ANSWER 18 OF 22 HCA COPYRIGHT 2004 ACS on STN
132:226263 Catalysts used in manufacturing superfine carbon
nanotubes. Ohshima, Akira; Yumura, Morio; Uchida, Kunio;
Igasaki, Fumikazu; Kuriki, Yasunori; Tanba, Shuichi; Minakami,
Fujio; Toba, Makoto (Agency for Industrial Science and Technology,
Japan). Jpn. Kokai Tokkyo Koho JP 2000086218 A2 20000328, 5 pp.
(Japanese). CODEN: JKXXAF. APPLICATION: JP 1998-267318 19980905.
- AB Superfine carbon **nanotubes** are deposited on porous inorg.
substrate and metal catalyst supported on a
substrate by reaction of thermal-decompn. of
hydrocarbons in the presence of thermal-decompn. promoter selected
from cyanuric acid, isocyanuric acid, and their derivs. The
superfine carbon **nanotubes** are manufd. with high yield at
low temp.
- IC ICM C01B031-02
ICS B01J031-02
- CC 57-8 (Ceramics)
- ST superfine carbon **nanotube** manuf catalyst; hydrocarbon
thermal decompn catalyst cyanuric acid; isocyanuric acid hydrocarbon
thermal decompn catalyst
- IT **Nanotubes**
(carbon; catalysts used in manufg. superfine carbon
nanotubes)
- IT Thermal decomposition catalysts
(catalysts used in manufg. superfine carbon **nanotubes**)
- IT Hydrocarbons, processes
(catalysts used in manufg. superfine carbon **nanotubes**)
- IT 108-80-5, Cyanuric acid 7429-90-5, Aluminum, uses 14024-48-7
21679-46-9, Cobalt acetylacetonate
(catalyst; catalysts used in manufg. superfine carbon
nanotubes)
- IT 71-43-2, Benzene, processes
(catalysts used in manufg. superfine carbon **nanotubes**)

- 131:211965 Correlated Atomic Force and Transmission Electron Microscopy of **Nanotubular** Structures in Pulmonary Surfactant. Nag, Kaushik; Munro, James G.; Hearn, Stephen A.; Rasmusson, Johan; Petersen, Nils O.; Possmayer, Fred (Department of Obstetrics & Gynecology, University of Western Ontario, London, ON, N5X 2L9, Can.). Journal of Structural Biology, 126(1), 1-15 (English) 1999. CODEN: JSBIEM. ISSN: 1047-8477. Publisher: Academic Press.
- AB Pulmonary surfactant stabilizes the lung by reducing surface tension at the air-water interface of the alveoli. Surfactant is present in the lung in a no. of morphol. forms, including tubular myelin (TM). TM is composed of unusual 40 .times. 40 nm square elongated proteolipid tubes. At. force microscopy (AFM) was performed on polymer-embedded Lowicryl and London Resin-White (LR-White) unstained thin sections. AFM was used in imaging regions of the sections where TM was detected by transmission electron microscopy (EM) of corresponding stained sections. Tapping- and contact-mode AFM imaging of the unstained sections contg. TM indicated a highly **heterogeneous surface** topog. with height variations ranging from 10 to 100 nm. In tapping-mode AFM, tubular myelin was seen as hemispherical protrusions of 30-70 nm in diam., with vertical dimensions of 5-8 nm. In contact-mode AFM and with phase imaging using a sharper (>10 nm nominal radius) probe, square open-ended tubes which resembled typical electron micrographs of such regions were obsd. The cross-hatch structures obsd. inside the tubes using EM were not obsd. using AFM, although certain multilobe structures and topog. heterogeneity were detected inside some tubes. Other regions of multilamellar bodies and some regions where such bilayer lamella appear to fuse with the tubes were found in assocn. with TM using AFM. EM of acetone-delipidated tubes in LR-White revealed rectangular tubular cores contg. cross-hatched structures, presumably protein skeletons. AFM surface topog. of these regions showed hollow depressions at positions at which the protein was anticipated instead of the protrusions seen in the lipid-contg. sections. Gold-labeled antibody to surfactant protein A was found assocd. somewhat randomly within the regions contg. the protein skeletons. The topog. of the gold particles was obsd. as sharp peaks in contact-mode AFM. This study suggests a method for unambiguous detection of three-dimensional **nanotubes** present in low abundance in a biol. macromol. complex. Only limited detection of proteins and lipids in surfaces of embedded tubular myelin was possible. EM and AFM imaging of such unusual biol. structures may suggest unique lipid-protein assocns. and arrangements in three dimensions. (c) 1999 Academic Press.
- CC 13-1 (Mammalian Biochemistry)
Section cross-reference(s): 6, 9
- ST pulmonary surfactant **nanotube** tubular myelin; surface
topog pulmonary surfactant EM AFM
- IT Surfactant proteins (pulmonary)

- (SP-A; correlated at. force and transmission electron microscopy of **nanotubular** structures in pulmonary surfactant)
- IT Atomic force microscopy
- Nanotubes**
- Pulmonary surfactant
- Surface structure
- Transmission electron microscopy
- (correlated at. force and transmission electron microscopy of **nanotubular** structures in pulmonary surfactant)
- IT Myelin
- (tubular; correlated at. force and transmission electron microscopy of **nanotubular** structures in pulmonary surfactant)

L267 ANSWER 20 OF 22 HCA COPYRIGHT 2004 ACS on STN

128:93442 Atomic-scale fabrication of **metal surfaces**

by using adsorption and chemical reaction. Tanaka, Ken-Ichi; Matsumoto, Yuji; Fujita, Takaya; Okawa, Yuji (The Institute for Solid State Physics, the University of Tokyo, Tokyo, 106, Japan). In-Situ Microscopy in Materials Research, 225-261. Editor(s): Gai, Pratibha L. Kluwer: Boston, Mass. (English) 1997. CODEN: 65KCAV.

- AB A review with 34 refs. on the at.-scale fabrication of **metal surfaces** by using adsorption and chem. reaction. Oxygen atoms adsorbed at the four-fold hollow site of Cu(100) surface make nano-size $c(2 \times 2)$ -O domains to avoid the convergence of the stress induced by the adsorption. When a large $c(2 \times 2)$ -O domain appears on the surface, Cu atoms are missed from the surface to remove the stress and the $(2 \times \sqrt{2})$ -R45.degree. reconstruction is established. Contrary to this, formation of a quasi-compd. of (-Cu-O-) strings and their array in a (2×1) structure is responsible for the $p(2 \times 1)$ reconstruction of Cu(110) by O₂ which is different from the adsorption induced reconstruction of the surface. When a Ni atom is vaporized on a nano-size $c(2 \times 2)$ -O surface or on a $(2 \times \sqrt{2})$ -R45.degree.-O surface of Cu(100), one at. height Ni(100)-O $c(2 \times 2)$ islands are epitaxially grown, where the Ni-island grown on a nano-size $c(2 \times 2)$ -O surface takes isotropic shape but the island grown on a **nano-wire** on $(2 \times \sqrt{2})$ -R45.degree.-O surface takes extremely anisotropic shape of nano-size Ni-wire. The reaction of Cu atoms with a quasi-compd. of (-Ag-O-) strings on Ag(110) yields a new quasi-compd. of (-Cu-O-) strings on the Ag(110) surface by a reversible reaction of (-Cu-O-) .dblharw. (Cu)₆ + O₂- A chem. transportation of Cu atoms from a W-tip onto the Ag(110) surface and a photo-chem. reaction of (-Ag-O-) on Ag(110) are also explained by the reaction of quasi-compds. These results would suggest a possibility for the at.-scale patterning and at.-scale fabrication of the surface by using chem. reaction.

- CC 66-0 (Surface Chemistry and Colloids)
Section cross-reference(s): 56, 65, 67, 75
- ST review atomic **reaction metal surface**
adsorption; copper nickel silver atomic oxygen review;
surface reconstruction **reaction** quasicompound
review
- IT Adsorbed substances
Adsorption
Quasimolecules
Surface reaction
Surface reconstruction
Surface structure
(at.-scale fabrication of **metal surfaces** by
using adsorption and chem. reaction)
- IT 7440-02-0, Nickel, properties 7440-22-4, Silver, properties
7440-50-8, Copper, properties 17778-80-2, Atomic oxygen,
properties
(at.-scale fabrication of **metal surfaces** by
using adsorption and chem. reaction)
- L267 ANSWER 21 OF 22 HCA COPYRIGHT 2004 ACS on STN
127:168725 Electroluminescent **solid state** devices
based on silicon **nanowires**, fabricated by using
lithography and etching techniques. Nassiopoulos, A. G.;
Grigoropoulos, S.; Papadimitriou, D. (Institute of Microelectronics,
NCSR Demokritos, P.O. Box 60 228, 153 10 Aghia, Paraskevi Attikis,
Athens, Greece). Thin Solid Films, 297(1-2), 176-178 (English)
1997. CODEN: THSFAP. ISSN: 0040-6090. Publisher: Elsevier.
- AB Si quantum wires as Si pillars on Si were fabricated by using
lithog. and etching techniques. They were then used to fabricate
electroluminescent Si devices and to start the study of carrier
transport through the wires. Isolation between wires was achieved
by a nonconductive transparent polymer which was used to fill in the
device area and to form a solid matrix for the thin Si pillars. A
semitransparent Au layer, 15-20 nm thick, or In Sn oxide, 100 nm
thick, was used as contact metal. The diodes showed rectifying
behavior and electroluminescence at room temp. at forward bias. The
onset of light emission was in general at a bias voltage of the
order of 10-12 V but in some cases light was obsd. at much lower
voltages (3-5 V). Light emission was stable over several hours of
operation.
- CC 73-11 (Optical, Electron, and Mass Spectroscopy and Other Related
Properties)
Section cross-reference(s): 76
- IT Photolithography
(UV; electroluminescent **solid state** devices
based on silicon **nanowires**, fabricated by using
lithog. and etching techniques)

- IT Electric current-potential relationship
Electric transport properties
Electroluminescent devices
Quantum wire devices
Quantum wire devices
(electroluminescent **solid state** devices
based on silicon **nanowires**, fabricated by using
lithog. and etching techniques)
- IT Etching
(plasma; electroluminescent **solid state**
devices **based** on silicon **nanowires**,
fabricated by using lithog. and etching techniques)
- IT 7440-57-5, Gold, uses 50926-11-9, ITO
(electroluminescent **solid state** devices
based on silicon **nanowires**, fabricated by using
lithog. and etching techniques)
- IT 7440-21-3, Silicon, uses 9011-14-7, PMMA
(electroluminescent **solid state** devices
based on silicon **nanowires**, fabricated by using
lithog. and etching techniques)

L267 ANSWER 22 OF 22 HCA COPYRIGHT 2004 ACS on STN

125:345938 Scanning tunneling microscopy and spectroscopy of a carbon
nanotube. Lin, N.; Ding, J.; Yang, S.; Cue, N. (Dep.
Physics, Hong Kong Univ. Sci. and Technol., Kowloon, Hong Kong).
Carbon, 34(10), 1295-1297 (English) 1996. CODEN: CRBNAH. ISSN:
0008-6223. Publisher: Elsevier.

AB Carbon **nanotubes** formed by sequential deposition of C60
and Nd@C82 on a graphite substrate. The tube surface was identical
to that of graphite but with a chiral angle of 6.4.degree.. The
index of helical structure of the tube was deduced and the tube was
metallic with no band gap. A helical arrangement of fullerenes was
obsd. on the outer wall of the **nanotube**.

CC 78-1 (Inorganic Chemicals and Reactions)

ST **nanotube** carbon prepn **surface** structure
metallic; metallic carbon **nanotube** prepn; surface
structure carbon **nanotube**; endohedral neodymium fullerene
deposition carbon **nanotube**; scanning tunneling microscopy
carbon **nanotube**

IT **Fullerenes**
(**tubular**, prepn. of carbon **nanotubes** from
fullerene and endohedral neodymium fullerene)

IT 99685-96-8, C60 Fullerene
(for prepn. of carbon **nanotubes** from fullerene and
endohedral neodymium fullerene)

IT 142979-10-0P
(for prepn. of carbon **nanotubes** from fullerene and
endohedral neodymium fullerene)

- IT 7440-44-0P, Carbon, preparation
(**nanotube** prepn. from fullerene and endohedral
neodymium fullerene and surface structure)
- IT 7782-42-5, Graphite, **reactions**
(**reactant** and **substrate** for prepn. of carbon
nanotubes from fullerene and endohedral neodymium
fullerene)

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L268 ANSWER 1 OF 19 HCA COPYRIGHT 2004 ACS on STN

139:300054 Mechanism for the growth of multiwalled carbon-
nanotubes from carbon black. Buchholz, D. B.; Doherty, S.
P.; Chang, R. P. H. (Department of Materials Science and
Engineering, Northwestern University, Evanston, IL, 60208, USA).
Carbon, 41(8), 1625-1634 (English) 2003. CODEN: CRBNAH. ISSN:
0008-6223. Publisher: Elsevier Science Ltd..

AB Multiwalled carbon-**nanotubes** have been grown from carbon
black by solid-state transformation at the anode of a modified
high-temp. arc-furnace without a catalyst. A mechanism for the
solid-state transformation of carbon black into **nanotubes**
is proposed. The migration of pentagon and heptagon defects present
in carbon black to regions of high tensile-stress is key to the
growth mechanism. The growth process can be broken into two stages.
The basic mechanism for both stages is the same; only the source of
the tensile stress that drives the **nanotube** growth
differs. In the initial stage of growth the necks between
carbon-black particles are lengthened into short **nanotubes**
by thermal forces. Electrostatic forces present in the plasma of
the high-temp. arc-furnace drive the subsequent extension of the
short **nanotubes** to multiple-micron lengths.

CC 76-11 (Electric Phenomena)

Section cross-reference(s): 75

ST multiwalled carbon **nanotube** prepn carbon black arc anode

IT **Nanotubes**

(carbon; mechanism for growth of multiwalled carbon-
nanotubes from carbon black)

IT Anodes

(elec. arc; mechanism for growth of multiwalled carbon-
nanotubes from carbon black)

IT Crystal defects

Electric arc

Electrostatic force

Solid state reaction

Tension

(mechanism for growth of multiwalled carbon-**nanotubes**
from carbon black)

- IT Carbon black, reactions
(mechanism for growth of multiwalled carbon-**nanotubes**
from carbon black)
- IT Diffusion
(of crystal defects; mechanism for growth of multiwalled carbon-
nanotubes from carbon black)
- IT Force
(thermal; mechanism for growth of multiwalled carbon-
nanotubes from carbon black)
- IT 7440-44-0P, Carbon, preparation
(**nanotubes**; mechanism for growth of multiwalled carbon-
nanotubes from carbon black)
- L268 ANSWER 2 OF 19 HCA COPYRIGHT 2004 ACS on STN
138:407430 Chemical reactions in applied magnetic fields. Pankhurst,
Quentin A.; Parkin, Ivan P. (Department of Physics and Astronomy,
University College London, London, WC1E 6BT, UK). Magnetism:
Molecules to Materials IV, 467-481. Editor(s): Miller, Joel S.;
Drillon, Marc. Wiley-VCH Verlag GmbH & Co. KGaA: Weinheim, Germany.
ISBN: 3-527-30429-0 (English) 2003. CODEN: 69DUVV.
- AB A review presents the dramatic influence that magnetic fields can
have on chem. reactions in gaseous, liq., and solid state. The
effect of applied magnetic fields on chem. reactions have uncovered
a wealth of intriguing phenomena in three states of matter, gases,
liqs., and solids.
- CC 67-0 (Catalysis, Reaction Kinetics, and Inorganic Reaction
Mechanisms)
Section cross-reference(s): 22, 77, 78
- IT **Nanotubes**
(carbon; magnetic field effects on gaseous, liq. and
solid-state reactions)
- IT Reaction
(liq.-phase; magnetic field effects on gaseous, liq. and
solid-state reactions)
- IT Combustion
Combustion synthesis
Electrodeposition
Magnetic field effects
Reaction
Reaction mechanism
Solid state reaction
(magnetic field effects on gaseous, liq. and **solid-**
state reactions)
- IT Fullerenes
(magnetic field effects on gaseous, liq. and **solid-**
state reactions)
- IT 7440-44-0P, Carbon, uses
(**nanotubes**; magnetic field effects on gaseous, liq. and

solid-state reactions)

L268 ANSWER 3 OF 19 HCA COPYRIGHT 2004 ACS on STN

138:145269 Solid-state room-temperature route to silver composite **nanowires**. Liu, Yuanfang; Cao, Jinbo; Zeng, Jinghui; Li, Cun; Qian, Yitai (Department of Chemistry, University of Science and Technology of China, Anhui, 230026, Peop. Rep. China). Journal of Materials Science Letters, 21(22), 1737-1738 (English) 2002. CODEN: JMSLD5. ISSN: 0261-8028. Publisher: Kluwer Academic Publishers.

AB A novel solid-state soft template method is developed to synthesize Ag/.beta.-cyclodextrin (.beta.-CD) composite **nanowires** at room temp. AgNO₃, .beta.-CD, and KBH₄ are used as starting mixt. materials. The formation of Ag/.beta.-CD composite **nanowires** is controlled by the structure of polymer .beta.-CD. This rapid solid-state room-temp. route may have potentially broad application in the synthesis and in the shape control of other nanometer powders.

CC 75-1 (Crystallography and Liquid Crystals)

ST silver cyclodextrin composite **nanowire** solid state prepn

IT **Nanowires**

Wires

(composite; solid-state room-temp. route to silver/.beta.-cyclodextrin composite **nanowires**)

IT IR spectra

Microstructure

Nanostructures

(solid-state room-temp. route to silver/.beta.-cyclodextrin composite **nanowires**)

IT Composites

(wire; solid-state room-temp. route to silver/.beta.-cyclodextrin composite **nanowires**)

IT 7440-22-4P, Silver, properties 7585-39-9P, .beta.-Cyclodextrin

(solid-state room-temp. route to silver/.beta.-cyclodextrin composite **nanowires**)

IT 7761-88-8, Silver nitrate, **reactions** 13762-51-1,

Potassium borohydride

(**solid-state** room-temp. route to silver/.beta.-cyclodextrin composite **nanowires**)

L268 ANSWER 4 OF 19 HCA COPYRIGHT 2004 ACS on STN

138:136671 Solvent free **reactions** in the **solid**

state: solid state metathesis. Parkin, Ivan P. (Department of Chemistry, University College London, London, WC1H 0AJ, UK). Transition Metal Chemistry (Dordrecht, Netherlands), 27(6), 569-573 (English) 2002. CODEN: TMCHDN. ISSN: 0340-4285. Publisher: Kluwer Academic Publishers.

AB A review. The use of **solid-state** metathesis **reactions** enabling a wide range of inorg. materials to be

made in seconds is reviewed and discussed. The reactions proceed by means of a solid flame or dark synthesis wave that transforms the starting reagents to the final products. Brief discussions are given for carbon **nanotube**, metal carbides, metal silicides, metal nitrides, metal phosphides, metal oxides, and metal sulfides syntheses.

CC 21-0 (General Organic Chemistry)
Section cross-reference(s): 55, 56

IT **Nanotubes**
(carbon; solvent-free solid-state metathesis for synthesis of inorg. materials)

L268 ANSWER 5 OF 19 HCA COPYRIGHT 2004 ACS on STN

138:97566 Application of laser-induced incandescence to the detection of carbon **nanotubes** and carbon **nanofibers**. Vander Wal, Randy L.; Berger, Gordon M.; Ticich, Thomas M.; Patel, Premal D. (National Center for Microgravity Research on Fluids and Combustion, NASA Glenn Research Center, Cleveland, OH, 44135-3191, USA). Applied Optics, 41(27), 5678-5690 (English) 2002. CODEN: APOPAI. ISSN: 0003-6935. Publisher: Optical Society of America.

AB Laser-induced incandescence applied to a **heterogeneous**, multielement **reacting** flow was characterized by temporally resolved emission spectra, time-resolved emission at selected detection wavelengths, and fluence dependence. Two-pulse laser measurements were used to further probe the effects of laser-induced changes on the optical signal. Laser fluences $>0.6 \text{ J/cm}^2$ at 1064 nm initiate laser-induced vaporization, yielding a lower incandescence intensity, as found through fluence-dependence measurements. Spectrally derived temps. show that values of excitation laser fluence greater than this value lead to superheated plasmas with temps. well above the vaporization point of C. The temporal evolution of the emission signal at these fluences is consistent with plasma dissipation processes, not incandescence from solid-like structures. Two-pulse laser expts. reveal that other material changes are produced at fluences below the apparent vaporization threshold, leading to nanostructures with different optical and thermal properties.

CC 73-5 (Optical, Electron, and Mass Spectroscopy and Other Related Properties)
Section cross-reference(s): 48

ST laser induced incandescence detection carbon **nanotube**
nanofiber

IT Emission spectra
Flame
Thermal decomposition
(application of laser-induced incandescence to the detection of carbon **nanotubes** and carbon **nanofibers** in acetylene flames)

- IT **Nanofibers**
 Nanotubes
 (carbon; application of laser-induced incandescence to the detection of carbon **nanotubes** and carbon **nanofibers** in acetylene flames)
- IT Catalysts
 (iron and nickel; application of laser-induced incandescence to the detection of carbon **nanotubes** and carbon **nanofibers** in acetylene flames)
- IT Emissivity
 (laser-induced; application of laser-induced incandescence to the detection of carbon **nanotubes** and carbon **nanofibers** in acetylene flames)
- IT 7440-44-0, Carbon, properties
 (application of laser-induced incandescence to the detection of carbon **nanotubes** and carbon **nanofibers** in acetylene flames)
- IT 7439-89-6, Iron, uses 7440-02-0, Nickel, uses
 (application of laser-induced incandescence to the detection of carbon **nanotubes** and carbon **nanofibers** in acetylene flames)
- IT 74-85-1, Ethylene, reactions
 (application of laser-induced incandescence to the detection of carbon **nanotubes** and carbon **nanofibers** in acetylene flames)
- IT 630-08-0, Carbon monoxide, uses 1333-74-0, Hydrogen, uses
 (flame contg.; application of laser-induced incandescence to the detection of carbon **nanotubes** and carbon **nanofibers** in acetylene flames)
- IT 13138-45-9, Nickel nitrate 14104-77-9, Iron nitrate
 (for catalysts; application of laser-induced incandescence to the detection of carbon **nanotubes** and carbon **nanofibers** in acetylene flames)
- IT 12005-21-9, YAG
 (laser; application of laser-induced incandescence to the detection of carbon **nanotubes** and carbon **nanofibers** in acetylene flames)
- IT 7440-00-8, Neodymium, uses
 (laser; application of laser-induced incandescence to the detection of carbon **nanotubes** and carbon **nanofibers** in acetylene flames)

L268 ANSWER 6 OF 19 HCA COPYRIGHT 2004 ACS on STN

137:161890 A **solid-state reaction** for the synthesis of CdS **nanowires**. Chen, Yuan-Tao; Guo, Yun; Kong, Ling-Bin; Li, Hu-Lin (College of Chemistry and Chemical Engineering, Lanzhou University, Lanzhou, 730000, Peop. Rep. China). Chemistry Letters (6), 602-603 (English) 2002. CODEN: CMLTAG.

ISSN: 0366-7022. Publisher: Chemical Society of Japan.

AB CdS **nanowires** have been successfully prepd. by **solid-state reaction** of Cd(Ac)₂.cntdot.2.5H₂O and Na₂S.cntdot.9H₂O in the presence of PEG 400 at room temp.

CC 76-2 (Electric Phenomena)

ST cadmium sulfide **nanowire** synthesis **solid state reaction**

IT **Nanowires**

(prepn. of CdS **nanowires** by **solid-state reaction** of Cd(Ac)₂.cntdot.2.5H₂O and Na₂S.cntdot.9H₂O in presence of PEG)

IT Polyoxyalkylenes, uses

(prepn. of CdS **nanowires** by **solid-state reaction** of Cd(Ac)₂.cntdot.2.5H₂O and Na₂S.cntdot.9H₂O in presence of PEG)

IT 1306-23-6P, Cadmium monosulfide, processes

(prepn. of CdS **nanowires** by **solid-state reaction** of Cd(Ac)₂.cntdot.2.5H₂O and Na₂S.cntdot.9H₂O in presence of PEG)

IT 25322-68-3, PEG

(prepn. of CdS **nanowires** by **solid-state reaction** of Cd(Ac)₂.cntdot.2.5H₂O and Na₂S.cntdot.9H₂O in presence of PEG)

IT 543-90-8, Cadmium acetate 1313-82-2, Sodium sulfide, reactions

(prepn. of CdS **nanowires** by **solid-state reaction** of Cd(Ac)₂.cntdot.2.5H₂O and Na₂S.cntdot.9H₂O in presence of PEG)

L268 ANSWER 7 OF 19 HCA COPYRIGHT 2004 ACS on STN

136:313776 Boron carbide nanolumps on carbon **nanotubes**. Lao, J. Y.; Li, W. Z.; Wen, J. G.; Ren, Z. F. (Department of Physics, Boston College, Chestnut Hill, MA, 02467, USA). Applied Physics Letters, 80(3), 500-502 (English) 2002. CODEN: APPLAB. ISSN: 0003-6951. Publisher: American Institute of Physics.

AB Boron carbide nanolumps are formed on the surface of multiwall carbon **nanotubes** by a **solid-state reaction** between boron and carbon **nanotubes**. The reaction is localized so that the integrity of the structure of carbon **nanotubes** is maintained. Inner layers of multiwall carbon **nanotubes** are also bonded to boron carbide nanolumps. These multiwall carbon **nanotubes** with boron carbide nanolumps are expected to be the ideal reinforcing fillers for high-performance composites because of the favorable morphol.

CC 57-8 (Ceramics)

ST carbon **nanotube** surface boron carbide nanolump formation

IT **Nanotubes**

(carbon; formation of boron carbide nanolumps on carbon

- nanotube surfaces)
- IT Nanostructures
(formation of boron carbide nanolumps on carbon **nanotube** surfaces)
- IT 12069-32-8P, Boron carbide (B4C)
(nanolumps; formation of boron carbide nanolumps on carbon **nanotube** surfaces)
- IT 7440-44-0, Carbon, processes
(**nanotubes**; formation of boron carbide nanolumps on carbon **nanotube** surfaces)
- L268 ANSWER 8 OF 19 HCA COPYRIGHT 2004 ACS on STN
136:159344 Lithium-Assisted Self-Assembly of Aluminum Carbide **Nanowires** and **Nanoribbons**. Zhang, Hai-Feng; Dohnalkova, Alice C.; Wang, Chong-Min; Young, James S.; Buck, Edgar C.; Wang, Lai-Sheng (Department of Physics, Washington State University, Richland, WA, 99352, USA). Nano Letters, 2(2), 105-108 (English) 2002. CODEN: NALEFD. ISSN: 1530-6984. Publisher: American Chemical Society.
- AB We report on the synthesis and self-assembly of Al4C3 **nanowires** and **nanoribbons** using lithium as a catalyst. Large quantities of Al4C3 **nanowires** (diams. from 5 to 70 nm) and **nanoribbons** (5-70 nm thick and 20-500 nm wide) tens of micrometers long were synthesized serendipitously in a **solid-state reaction** involving Al/C/Li at less than 780 .degree.C. High-resoln. electron microscopy revealed that the **nanowires** all grew along the c-axis of hexagonal Al4C3, whereas the **nanoribbons** all grew within the basal plane. The facile syntheses of the Al4C3 **nanowires** and **nanoribbons** suggest similar nanostructures of other carbide and nitride materials may be made using the lithium-assisted self-assembly process.
- CC 76-2 (Electric Phenomena)
- ST aluminum carbide **nanowire nanoribbon** assembly
lithium catalyst
- IT Catalysts
Nanowires
(lithium-assisted self-assembly of aluminum carbide **nanowires** and **nanoribbons**)
- IT 7439-93-2, Lithium, uses
(lithium-assisted self-assembly of aluminum carbide **nanowires** and **nanoribbons**)
- IT 1299-86-1P, Aluminum carbide (Al4C3)
(lithium-assisted self-assembly of aluminum carbide **nanowires** and **nanoribbons**)

L268 ANSWER 9 OF 19 HCA COPYRIGHT 2004 ACS on STN
136:23940 Novel synthesis of AlN **nanowires** with controlled

diameters. Liu, Jun; Zhang, X.; Zhang, Yingjiu; He, Rongrui; Zhu, Jing (Department of Materials Science and Engineering, Tsinghua University, Beijing, 100084, Peop. Rep. China). Journal of Materials Research, 16(11), 3133-3138 (English) 2001. CODEN: JMREEE. ISSN: 0884-2914. Publisher: Materials Research Society.

- AB A relatively low-cost, high-efficiency method is reported to synthesize AlN **nanowires**, using carbon **nanotubes** as templates. The AlN **nanowires** were fabricated at 1100.degree. for 60 min. The diams. of the product could be roughly controlled by the sizes of carbon **nanotubes** selected as starting materials. The AlN **nanowires** obtained were among the thinnest ever known. X-ray diffraction, selected-area diffraction, energy dispersive spectroscopy, and high-resoln. TEM, etc. were employed to characterize the products, which were found to be single crystals with some defects. The axes of the **nanowires** are normal to {10.hivin.10} crystal planes. A new synthesis mechanism is proposed.
- CC 57-2 (Ceramics)
- ST aluminum nitride **nanowire** ceramic prepn carbon **nanotube**
- IT **Nanotubes**
 (carbon; prepn. of AlN **nanowires** with controlled diams. using carbon **nanotube** templates)
- IT Powders
 (ceramic; prepn. of AlN **nanowires** with controlled diams. using carbon **nanotube** templates)
- IT Crystal orientation
 Crystal structure
 Microstructure
 (of AlN **nanowires** prepd. via carbon **nanotube** templates)
- IT Ceramics
 (powders; prepn. of AlN **nanowires** with controlled diams. using carbon **nanotube** templates)
- IT Nanoparticles
 (prepn. of AlN **nanowires** with controlled diams. using carbon **nanotube** templates)
- IT Reaction mechanism
 (**solid-state**; of AlN **nanowire** formation with carbon **nanotube** templates)
- IT 1344-28-1, Alumina, reactions 7429-90-5, Aluminum, reactions 7664-41-7, Ammonia, reactions
 (in prepn. of AlN **nanowires** with controlled diams. using carbon **nanotube** templates)
- IT 24304-00-5P, Aluminum nitride
 (prepn. of AlN **nanowires** with controlled diams. using carbon **nanotube** templates)

L268 ANSWER 10 OF 19 HCA COPYRIGHT 2004 ACS on STN

136:14637 Bi-Ba-Fe-O-Cl micro-**nanotube** of tetragonal prism crystal. Shen, Ruo-Fan; Wang, Fa-Yang; Xiong, Zhao-Xian; Xue, Ru (Dep. of Chem., Xiamen Univ., Xiamen, 361005, Peop. Rep. China). Wuli Huaxue Xuebao, 17(9), 824-827 (Chinese) 2001. CODEN: WHXUEU. ISSN: 1000-6818. Publisher: Beijing Daxue Chubanshe.

AB A micro-**nanotube** of new inorg. compd. with external shape of tetragonal prism was synthesized. It is made of transitional metal oxychloride. From SEM detection, the micro-**nanotube** has an external diam. of 100-500 nm and an internal diam. of 60-300 nm. Its wall is very thin, 20-70 nm, and its length is from a dozen micro to dozens of microns. It was prepd. by **solid state reaction** in a direct growth way. From XRD, TEM and SEM detn., the micro-**nanotube** crystal belongs to orthorhombic system and its lattice consts. are a 0.5864(2), b 0.6032(2) and c 2.972(2) nm. It possesses semiconducting properties. From curve $\log(1/p)$.apprx. $1/T$, its energy gap is E_g .apprxeq. 1.2 eV. The micro-**nanotube** material will be a prospect material used as catalysts, material to store gases or energy, and material used as electrode in photoelec. cell and photoelectrolytic cell. Addnl., the prepn. of the micro-**nanotube** material by **solid state reaction** is simple in operation and cheap in cost.

CC 78-5 (Inorganic Chemicals and Reactions)

Section cross-reference(s): 75, 76

ST barium bismuth iron chloride oxide **nanotube** prepn structure; crystal structure barium bismuth iron chloride oxide; band gap barium bismuth iron chloride oxide; semicond barium bismuth iron chloride oxide

IT **Nanotubes**

(prepn. of micro-**nanotubes** of barium bismuth iron chloride oxide)

IT 376355-56-5P, Barium bismuth iron chloride oxide

(prepn. and crystal structure and semicond. and band gap of micro-**nanotubes**)

L268 ANSWER 11 OF 19 HCA COPYRIGHT 2004 ACS on STN

135:63221 Single-wall carbon **nanotubes** production by **heterogeneous catalytic reaction**. Kitiyanan, Boonyarach (Univ. of Oklahoma, Norman, OK, USA). 157 pp. Avail. UMI, Order No. DA9972510 From: Diss. Abstr. Int., B 2000, 61(5), 2651 (English) 2000.

AB Unavailable

CC 48-8 (Unit Operations and Processes)

ST **heterogeneous catalytic reaction** carbon **nanotube** prodn

IT **Nanotubes**

(carbon; single-wall carbon **nanotubes** prodn. by

heterogeneous catalytic reaction)

IT Reaction

(single-wall carbon **nanotubes** prodn. by
heterogeneous catalytic reaction)

L268 ANSWER 12 OF 19 HCA COPYRIGHT 2004 ACS on STN

134:216377 Rapid solid-state synthesis of Group 6 nitrides, carbon
nanotubes and graphite-encapsulated metal nanoparticles.

O'Loughlin, Jennifer Leigh (Univ. California, Los Angeles, USA).

167 pp. Avail. UMI, Order No. DA9961640 From: Diss. Abstr. Int., B
2000, 61(2), 850-851 (English) 2000.

AB Unavailable

CC 78-7 (Inorganic Chemicals and Reactions)

ST solid state metathesis prepn Group 6 nitride carbon **nanotube**
; transition metal nanoparticle graphite encapsulated prepnIT **Nanotubes**

(carbon; rapid prepn. by solid-state metathesis)

IT **Solid state reaction**

(metathesis; for rapid **solid-state** prepn. of
Group 6 nitrides, carbon **nanotubes** and
graphite-encapsulated metal nanoparticles)

IT Metathesis

(solid-state; for rapid solid-state prepn. of Group 6 nitrides,
carbon **nanotubes** and graphite-encapsulated metal
nanoparticles)

L268 ANSWER 13 OF 19 HCA COPYRIGHT 2004 ACS on STN

134:153111 Rapid Synthesis of Carbon **Nanotubes** by**Solid-State Metathesis Reactions.**

O'Loughlin, J. L.; Kiang, C.-H.; Wallace, C. H.; Reynolds, T. K.;
Rao, L.; Kaner, R. B. (Department of Chemistry and Biochemistry and
Exotic Materials Institute, University of California Los Angeles,
Los Angeles, CA, 90095-1569, USA). Journal of Physical Chemistry B,
105(10), 1921-1924 (English) 2001. CODEN: JPCBFK. ISSN: 1089-5647.
Publisher: American Chemical Society.

AB **Solid-state exchange reactions** between

carbon halides and lithium acetylide catalyzed by cobalt dichloride
enable the rapid synthesis of carbon **nanotubes** as obsd. by
TEM. Without the catalyst, only graphite and amorphous carbon form.
These reactions are self-propagating and can be initiated with a
heated filament. Regulating the reaction temp. provides a method
for controlling these reactions. The theor. temp. for a reaction
between hexachloroethane and lithium acetylide is 2302 K assuming
adiabatic conditions. Calcns. indicate that increasing the length
of the carbon chain can lower the reaction temp. by up to 61 K.
Replacing chlorine with fluorine can further reduce the temp. by up
to 384 K. Replacing chlorine with hydrogen can, in principle, lower
the reaction temp. by up to 925 K. These calcns. suggest that

polymers such as poly(vinyl chloride), poly(vinylidene chloride), and poly(tetrafluoroethylene) can be used as precursors to carbon **nanotubes**. This is confirmed exptl. using a copolymer of poly(vinyl chloride) and poly(vinylidene chloride) with a 5 mol % (based on carbon) iron trichloride catalyst to produce multi-walled carbon **nanotubes**.

CC 67-2 (Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms)

ST rapid synthesis carbon **nanotube solid state** metathesis **reaction** catalysis; carbon halide lithium acetylide reaction cobalt chloride catalyst **nanotube** ; vinyl chloride vinylidene chloride copolymer reaction carbon **nanotube** synthesis

IT Group IVA element compounds
(carbon halides; rapid synthesis of carbon **nanotubes** by **solid-state** metathesis **reactions**)

IT **Nanotubes**
(carbon; rapid synthesis of carbon **nanotubes** by **solid-state** metathesis **reactions**)

IT Catalysts
Metathesis
(rapid synthesis of carbon **nanotubes** by **solid-state** metathesis **reactions**)

IT Fluoropolymers, reactions
(rapid synthesis of carbon **nanotubes** by **solid-state** metathesis **reactions**)

IT 7646-79-9, Cobalt dichloride, uses 7705-08-0, Iron trichloride, uses
(rapid synthesis of carbon **nanotubes** by **solid-state** metathesis **reactions**)

IT 7440-44-0P, Carbon, properties
(rapid synthesis of carbon **nanotubes** by **solid-state** metathesis **reactions**)

IT 67-72-1, Hexachloroethane 1070-75-3, Lithium acetylide 9002-84-0, PTFE 9011-06-7, Vinyl chloride-vinylidene chloride copolymer
(rapid synthesis of carbon **nanotubes** by **solid-state** metathesis **reactions**)

L268 ANSWER 14 OF 19 HCA COPYRIGHT 2004 ACS on STN

133:259875 Controllable method for fabricating single-wall carbon **nanotube** tips. Zhang, Y.; Iijima, S. (Fundamental Research Laboratories, NEC Corporation, Tsukuba, Ibaraki, 305-8501, Japan). Applied Physics Letters, 77(7), 966-968 (English) 2000. CODEN: APPLAB. ISSN: 0003-6951. Publisher: American Institute of Physics.

AB Single-wall carbon **nanotubes** (SWCNTs) were abruptly cut with a niobium substrate after a heating process in an ultrahigh vacuum transmission electron microscope. The cutting was attributed

to a break of weakly bonded interface between carbon **nanotubes** and niobium carbide that formed as a product of a solid-phase reaction. This effect provided a controllable method for prepg. well-defined **SWCNT** tips in future field-emission applications.

CC 76-2 (Electric Phenomena)

ST carbon **nanotube** tip transmission electron microscope

IT Cutting

Heating

Interface

Nanotubes

Solid state reaction

Transmission electron microscopes

(controllable method for fabricating single-wall carbon **nanotube** tips)

IT 7440-44-0, Carbon, uses

(controllable method for fabricating single-wall carbon **nanotube** tips)

IT 7440-03-1, Niobium, properties 12069-94-2, Niobium carbide

(controllable method for fabricating single-wall carbon **nanotube** tips)

L268 ANSWER 15 OF 19 HCA COPYRIGHT 2004 ACS on STN

132:72688 Vanadium(IV)-Oxide **Nanotubes**: Crystal Structure of the Low-Dimensional Quantum Magnet Na₂V₃O₇. Millet, P.; Henry, J. Y.; Mila, F.; Galy, J. (Centre d'Elaboration de Materiaux et d'Etudes Structurales, CNRS, Toulouse, 31055, Fr.). Journal of Solid State Chemistry, 147(2), 676-678 (English) 1999. CODEN: JSSCBI. ISSN: 0022-4596. Publisher: Academic Press.

AB Fibers of Na₂V₃O₇ were obtained by **solid state reaction**. This compd. crystallizes in the trigonal system, space group P31c, with a 10.886(1), b 9.5380(1) .ANG., V = 978.87(2), Z = 6, and .rho. = 3.163 g cm⁻¹. The structure is built up by VO₅ square pyramids connected via edges and apexes to form fascinating V(IV)-oxide **nanotubes**. The cohesion of the network is ensured by the Na atoms which are located around the **nanotubes**. The inner diam. of the **nanotube** is .apprx.5 .ANG., which can accommodate the presence of a Na atom NaI inside the **nanotube**. Such geometry with all the vanadium atoms in the valence state IV should give interesting ionic cond. and magnetic properties (no data). (c) 1999 Academic Press.

CC 78-2 (Inorganic Chemicals and Reactions)

Section cross-reference(s): 75

ST crystal structure sodium vanadium oxide **nanotube**; sodium vanadium oxide **nanotube** solid state prepn

IT **Solid state reaction**

(for prepn. of sodium vanadium oxide **nanotube**)

IT Crystal structure

- (of sodium vanadium oxide **nanotube**)
- IT **Nanotubes**
(vanadium oxide; solid-state prepn. and crystal structure of sodium vanadium oxide **nanotube**)
- IT 253150-96-8, Sodium vanadium oxide (Na_{1.9}V₂O₅)
(for solid-state prepn. of sodium vanadium oxide **nanotube**)
- IT 168180-42-5P, Sodium vanadium oxide (Na₂V₃O₇)
(**nanotube**; solid-state prepn. and crystal structure of)
- L268 ANSWER 16 OF 19 HCA COPYRIGHT 2004 ACS on STN
131:299156 **Heterogeneous reactions** on metal catalysts on new carbon materials. Takeguchi, Tatsuya (Grad. Sch. Eng., Kyoto Univ., Kyoto, 606-8501, Japan). Shokubai, 41(5), 330-331 (Japanese) 1999. CODEN: SHKUJ. ISSN: 0559-8958. Publisher: Shokubai Gakkai.
- AB A review with 5 refs. Based on Coq's papers, studies on fullerene-based materials as the catalyst support were reviewed. Their attempts to synthesize the thermally stable new carbon material were described. It was reported that carbon **nanotubes** were formed on Ni catalyst supported on zirconia. The new method of catalyst design was discussed.
- CC 22-0 (Physical Organic Chemistry)
Section cross-reference(s): 67
- ST review fullerene catalyst support **heterogeneous reaction**
- IT Fullerenes
(catalyst supports; **heterogeneous reactions** on metal catalysts supported on new carbon materials)
- IT Catalysts
(fullerene-supported; **heterogeneous reactions** on metal catalysts supported on new carbon materials)
- IT Catalyst supports
(fullerenes; **heterogeneous reactions** on metal catalysts supported on new carbon materials)
- IT Metals, uses
(**heterogeneous reactions** on metal catalysts supported on new carbon materials)

- L268 ANSWER 17 OF 19 HCA COPYRIGHT 2004 ACS on STN
131:138276 Dense arrays of well-aligned carbon **nanotubes** completely filled with single crystalline titanium carbide wires on titanium substrates. Gao, Y.; Liu, J.; Shi, M.; Elder, S. H.; Virden, J. W. (Pacific Northwest National Laboratory, Richland, WA, 99352, USA). Applied Physics Letters, 74(24), 3642-3644 (English) 1999. CODEN: APPLAB. ISSN: 0003-6951. Publisher: American Institute of Physics.
- AB The authors report the synthesis of dense and uniform arrays of

well-aligned carbon **nanotubes** on titanium substrates over large areas, in which all the tubes are simultaneously and completely filled with single crystals of titanium carbide. The carbon **nanotubes** were synthesized by thermal CVD of ethylene on iron-coated substrates, while the titanium carbide was simultaneously formed inside the **nanotubes** through a simultaneous **solid state reaction**.

The authors propose a base dissoln. and pptn. mechanism for the growth of titanium carbide filled carbon **nanotubes**. The same method can be used to fabricate oriented **nanotube** arrays filled with other carbides on a variety of substrates over large scale. Such well-aligned and densely packed uniform carbon **nanotubes**, completely filled with **nanowires** on conducting substrates, will have great potential in many applications.

CC 78-3 (Inorganic Chemicals and Reactions)

ST carbon **nanotube** titanium carbide **nanowire** prepn

IT **Nanotubes**

(carbon, titanium carbide filled; prepn. of carbon **nanotubes** filled with titanium carbide **nanowires**)

IT 12070-08-5DP, Titanium carbide, carbon **nanotube** encapsulated

(prepn. of carbon **nanotubes** filled with titanium carbide **nanowires**)

IT 74-85-1, Ethene, reactions

(reactant for prepn. of carbon **nanotubes** filled with titanium carbide **nanowires**)

IT 7440-32-6, Titanium, reactions

(substrate for prepn. of carbon **nanotubes** filled with titanium carbide **nanowires**)

L268 ANSWER 18 OF 19 HCA COPYRIGHT 2004 ACS on STN

131:75687 Using carbon **nanotubes** for the synthesis of transition metal carbide nanoparticles. Fukunaga, A.; Chu, S.; McHenry, M. E. (Mechanical Design Department, Nippon Oil Engineering and Construction Company, Ltd., Yokohama, 231-0062, Japan). Journal of Materials Science Letters, 18(6), 431-433 (English) 1999. CODEN: JMSLD5. ISSN: 0261-8028. Publisher: Kluwer Academic Publishers.

AB Nanoparticles of TiC, NbC, and TaC were synthesized by a **solid-state reaction** using carbon **nanotubes**. The structure of the resulting materials was analyzed by x-ray diffraction and high-resoln. SEM. Multilayer C **nanotubes** (synthesized by metal-catalyzed growth using ethylene), transition metals (Ti, Nb, Ta) and a small amt. of iodine were packed in quartz ampoules and heated to 1000.degree. for 168-215 h. The morphologies of the nanoparticles were spherical, and faceted structures were obsd. The spheres for TiC, NbC, and TaC

were 100 nm in diam. The faceted faces and crystal sizes, however, were different up to the transition metals.

CC 49-5 (Industrial Inorganic Chemicals)

ST transition metal carbide nanoparticle synthesis; carbon
nanotube metal carbide nanoparticle synthesis

IT **Nanotubes**

(carbon; using carbon **nanotubes** for synthesis of
transition metal carbide nanoparticles)

IT Nanoparticles

Solid state reaction

(using carbon **nanotubes** for synthesis of transition
metal carbide nanoparticles)

IT Transition metal carbides

(using carbon **nanotubes** for synthesis of transition
metal carbide nanoparticles)

IT 7553-56-2, Iodine, uses

(transport agent; using carbon **nanotubes** for synthesis
of transition metal carbide nanoparticles)

IT 7440-03-1, Niobium, reactions 7440-25-7, Tantalum, reactions
7440-32-6, Titanium, reactions

(using carbon **nanotubes** for synthesis of transition
metal carbide nanoparticles)

IT 12069-94-2P, Niobium carbide nbc 12070-06-3P, Tantalum carbide tac
12070-08-5P, Titanium carbide tic

(using carbon **nanotubes** for synthesis of transition
metal carbide nanoparticles)

L268 ANSWER 19 OF 19 HCA COPYRIGHT 2004 ACS on STN

130:343497 Environmental high resolution electron microscopy of
gas-catalyst reactions. Gai, Pratibha L. (DuPont Science and
Engineering Laboratories, Central Research and Development,
Wilmington, DE, 19880-0356, USA). Topics in Catalysis, 8(1,2),
97-113 (English) 1999. CODEN: TOCAFI. ISSN: 1022-5528. Publisher:
Baltzer Science Publishers.

AB A review with 46 refs.; environmental electron microscopy has become
an important scientific method for fundamental studies of dynamic
chem. **reaction** processes in **heterogeneous**
catalysis and of catalytic growth of carbon **nanotubes**.
Outstanding contributions are resulting from the ability to observe
gas-catalyst surface reactions in situ, on the at. scale. A great
deal of structural and chem. information including lattice
modification of working catalysts is possible. This is key to
understanding novel reaction processes, including release mechanism
of structural oxygen in oxide catalysts in selective oxidn. of
hydrocarbons and to designing improved catalysts. This brief survey
of the recent spectacular developments in environmental high resolu.
electron microscopy shows that new opportunities are being opened up
in catalysis.

CC 67-0 (Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms)
IT Catalysis
Catalysts
Electron microscopy
 Nanotubes
Oxidation catalysts
 (environmental high resolu. electron microscopy of gas-catalyst reactions)

=> d 1269 1-30 cbib abs hitind

L269 ANSWER 1 OF 30 HCA COPYRIGHT 2004 ACS on STN

139:402156 Bottom-up approach in **Si** technology **based** on surface structure design. Ogino, T.; Homma, Y.; Kobayashi, Y.; Hibino, H.; Prabhakaran, K.; Sumitomo, K.; Omi, H.; Bottomley, D.; Kaneko, A.; Ling, F. (NTT Basic Research Laboratories, Kanagawa, 243-0198, Japan). Proceedings - Electrochemical Society, 2002-2(Semiconductor Silicon 2002, Volume 2), 992-1002 (English) 2002. CODEN: PESODO. ISSN: 0161-6374. Publisher: Electrochemical Society.

AB Nanofabrication based on the at. structures of the substrate is called a bottom-up approach. Since individual nanostructures self-assemble in this approach, methods of controlling size, shape, position, and spacing are vitally important. Techniques for at. step arrangement control allow the steps to be used as a template for controlling the self-assembly of Ge nanostructures on Si(111). Strain engineering is particularly important in controlling Ge nanostructures on Si(001). Strain engineering can also be used for shape and spacing control. In realizing the concept of the self-assembled nanoarchitecture, an interconnection technique is equally important to the semiconductor nanostructures themselves. As a self-assembling nanointerconnection material, carbon **nanotubes** have excellent properties. Bridging Si dots using carbon **nanotubes** grown by chem. vapor deposition is demonstrated.

CC 76-3 (Electric Phenomena)
Section cross-reference(s): 66
ST silicon **semiconductor** device fabrication **surface** structure
IT Nanostructures
 Nanowires
Quantum dot devices
Self-assembly
Semiconductor device fabrication
Stepped surface structure
Strain

Surface structure

(**bottom-up** approach in **Si** technol.

based on surface structure design)

IT **Nanotubes**

(carbon, CVD; **bottom-up** approach in **Si** technol. **based** on surface structure design)

IT Interconnections, electric

(nanointerconnection; **bottom-up** approach in **Si** technol. **based** on surface structure design)

IT 7440-21-3, Silicon, processes

(**bottom-up** approach in **Si** technol. **based** on surface structure design)

IT 7440-44-0P, Carbon, uses

(**nanotubes**, CVD; **bottom-up** approach in **Si** technol. **based** on surface structure design)

IT 7440-56-4, Germanium, processes

(self-assembly; **bottom-up** approach in **Si** technol. **based** on surface structure design)

L269 ANSWER 2 OF 30 HCA COPYRIGHT 2004 ACS on STN

139:312898 Selective thiolation of single-walled carbon

nanotubes. Lim, Jong Kuk; Yun, Wan Soo; Yoon, Myung-han; Lee, Sun Kyung; Kim, Chang Hwan; Kim, Kwan; Kim, Seong Keun (School of Chemistry, Seoul National University, Seoul, 151-747, S. Korea). Synthetic Metals, 139(2), 521-527 (English) 2003. CODEN: SYMEDZ. ISSN: 0379-6779. Publisher: Elsevier Science B.V..

AB Single-walled carbon **nanotubes** (SWCNTs) were derivatized with thiol groups at the **ends** of the **nanotubes**.

The carbon **nanotubes** (CNTs) were treated with acid mixts. and modified through a series of chem. reactions. Fourier transform IR (FT-IR) spectroscopy and NMR (NMR) spectroscopy were used to verify the intermediate products of the oxidn. and redn. reactions and the final products. The thiolated CNTs were adsorbed on micron-sized silver and gold particles as well as gold surfaces to study the interaction between the thiol groups of the **nanotube** and the noble metals. The thiol-metal adhesion was studied by SEM (SEM), at. force microscopy (AFM), wavelength dispersive electron spectroscopy, and Raman spectroscopy. A new type of bonding between the **CNT** and a noble **metal surface** was proposed that involves a bow-type single-walled **nanotube** (SWNT) with its two **ends** strongly attached to the **metal surface**.

CC 66-3 (Surface Chemistry and Colloids)

Section cross-reference(s): 78

ST selective thiolation surface single walled carbon **nanotube**

IT **Nanotubes**

(carbon, single-walled; selective thiolation of single-walled carbon **nanotubes**)

- IT Carboxylation
Chlorination
Reduction
(selective thiolation of single-walled carbon **nanotubes** via)
- IT Substitution reaction
(thiolation; selective thiolation of single-walled carbon **nanotubes**)
- IT 7440-44-0, Carbon, properties
(**nanotubes**, single-walled; selective thiolation of single-walled carbon **nanotubes**)
- IT 7719-09-7, Thionyl chloride
(selective thiolation of single-walled carbon **nanotubes** using)

L269 ANSWER 3 OF 30 HCA COPYRIGHT 2004 ACS on STN

139:13004 Boron Nitride **Nanotubes** Filled with Ni and NiSi₂

Nanowires in Situ. Tang, Chengchun; Bando, Yoshio; Golberg, Dmitri; Ding, Xiaoxia; Qi, Shouren (Advanced Materials Laboratory, National Institute for Materials Science, Tsukuba, Ibaraki, 305-0044, Japan). Journal of Physical Chemistry B, 107(27), 6539-6543 (English) 2003. CODEN: JPCBFK. ISSN: 1520-6106. Publisher: American Chemical Society.

- AB An in situ synthesis method to fill boron nitride (BN) **nanotubes** with metals or metal alloys was proposed using a vapor-liq.-solid catalytic growth mechanism. Nickel fillings could be obtained by using nickel foil or a **silicon substrate** covered with nickel film during catalytic growth of pure BN **nanotubes**. The filled nickel **nanowires** usually connect to nanoparticles at the tip-end of BN **nanotubes**. Extensive structural investigations display the general existence of 4-fold superstructures along the [100] and [110] axes. The superstructures ensure the existence of one set of {223} planes of the cubic nickel parallel to the BN sheet, its planar distance are four times the interplanar spacing of the BN **nanotubes** shell, and the Ni-Ni distance in this plane is equal to the B-B and N-N distance. The (223) plane grows directly on the (0002) plane of the BN tubular layer according to a lattice-match relationship between the BN shell and the cubic nickel. NiSi₂ **nanowires** could also fill BN **nanotubes** when using a **silicon substrate** covered with a nickel film. The alloy **nanowires** have the growth axis along the [0-11] direction and the (-422) planes grow parallel to the innermost BN shells. The grown plane has the three times planar distance of the BN (0002) shells, and the at. distance in this plane accords with B-B and N-N bonds. All the results indicate that metal Ni and NiSi₂ crystallizes on the innermost shell of the BN **nanotubes** at a specified plane restricted by the

- all-space lattice-match relationship. Investigations further confirm the nanometallurgical behavior: crystn. of liq. metals is strongly confined by BN **nanotube** geometry.
- CC 67-3 (Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms)
Section cross-reference(s): 75
- ST boron nitride **nanotubes** filled nickel silicide
nanowire
- IT Catalysts
Crystallization
Nanotubes
Nanowires
(boron nitride **nanotubes** filled with Ni and NiSi₂ **nanowires** in situ)
- IT 7440-02-0, Nickel, uses 12201-89-7, Nickel disilicide
(boron nitride **nanotubes** filled with Ni and NiSi₂ **nanowires** in situ)
- IT 10043-11-5, Boron nitride, uses
(boron nitride **nanotubes** filled with Ni and NiSi₂ **nanowires** in situ)
- L269 ANSWER 4 OF 30 HCA COPYRIGHT 2004 ACS on STN
- 138:361188 Fabrication approach for molecular memory arrays. Li, Chao; Zhang, Daihua; Liu, Xiaolei; Han, Song; Tang, Tao; Zhou, Chongwu; Fan, Wendy; Koehne, Jessica; Han, Jie; Meyyappan, Meyya; Rawlett, A. M.; Price, D. W.; Tour, J. M. (Department of E.E.-Electrophysics, University of Southern California, Los Angeles, CA, 90089, USA). Applied Physics Letters, 82(4), 645-647 (English) 2003. CODEN: APPLAB. ISSN: 0003-6951. Publisher: American Institute of Physics.
- AB We present an approach to tackle long-standing problems in contacts, thermal damage, pinhole induced short circuits and interconnects in mol. electronic device fabrication and integration. Our approach uses metallic **nanowires** as **top** electrodes to connect and interconnect mol. wires assembled on electrode arrays in crossbar architectures. Using this simple and reliable approach, we have revealed intriguing memory effects for several different mol. wires, and demonstrated their applications in mol. memory arrays. Our approach has great potential to be used for fast screening of mol. wire candidates and construction of mol. devices.
- CC 76-14 (Electric Phenomena)
- IT Electric current-potential relationship
Memory devices
Nanowires
(fabrication approach for mol. memory arrays)
- IT 7440-05-3, Palladium, uses
(**nanowires**; fabrication approach for mol. memory arrays)
- IT 7440-21-3, Silicon, uses

(**substrate**; fabrication approach for mol. memory arrays)

L269 ANSWER 5 OF 30 HCA COPYRIGHT 2004 ACS on STN

138:327093 Formation of hexagonal Gd disilicide **nanowires** on Si(100). Lee, Dohyun; Kim, Sehun (Department of Chemistry and School of Molecular Science (BK 21), Korea Advanced Institute of Science and Technology, Daejeon, 305-701, S. Korea). Applied Physics Letters, 82(16), 2619-2621 (English) 2003. CODEN: APPLAB. ISSN: 0003-6951. Publisher: American Institute of Physics.

AB The growth of hexagonal Gd disilicide **nanowires** on Si(100) is studied by scanning tunneling microscopy. Gd disilicide **nanowires** are grown on Si(100) by submonolayer Gd deposition on the substrate at 600.degree.. The formation of **nanowires** is shown to be due to anisotropic lattice mismatches between hexagonal Gd disilicide and Si. The **nanowires** have widths of several nanometers and lengths up to micrometer length scales. The **top** of the **nanowires** has a c(2.times.2) structure, indicating that the cryst. structure is Si-deficient Gd disilicide. The **nanowires** were shown to have metallic properties using scanning tunneling spectroscopy.

CC 66-3 (Surface Chemistry and Colloids)

ST gadolinium silicide **nanowire** adsorption **silicon surface**

IT Adsorbed substances

Nanowires

Surface structure

(hexagonal Gd disilicide **nanowires** on Si(100))

IT 12134-75-7, Gadolinium disilicide

(hexagonal Gd disilicide **nanowires** on Si(100))

IT 7440-21-3, Silicon, properties

(hexagonal Gd disilicide **nanowires** on Si(100))

L269 ANSWER 6 OF 30 HCA COPYRIGHT 2004 ACS on STN

138:115689 A **top-gate carbon-nanotube** field-effect transistor with a titanium-dioxide insulator. Nihey, Fumiyuki; Hongo, Hiroo; Yudasaka, Masako; Iijima, Sumio (Fundamental Research Laboratories, NEC Corporation, Tsukuba, 305-8501, Japan). Japanese Journal of Applied Physics, Part 2: Letters, 41(10A), L1049-L1051 (English) 2002. CODEN: JAPLD8. Publisher: Japan Society of Applied Physics.

AB The authors developed a C-**nanotube** field-effect transistor (CNTFET), in which a gate electrode and a gate insulator are located on top of a semiconducting single-wall C **nanotube** channel on a **Si/SiO2 substrate**. The gate insulator is made of TiO2 and is 2-3 nm thick. The transconductance of this device at a drain voltage of 100 mV is 320 nS, which, due to the high dielec. const. and nanoscale thickness of the gate insulator,

is higher than that of any back-gate and top-gate CNTFETs reported so far.

CC 76-3 (Electric Phenomena)

ST titania carbon **nanotube** gate dielec MOSFET

IT **Nanotubes**

(carbon; **top-gate carbon-nanotube**

field-effect transistor with titanium-dioxide insulator)

IT Dielectric films

Drain current

Electric current-potential relationship

Leakage current

MOSFET (transistors)

Transconductance

(**top-gate carbon-nanotube** field-effect

transistor with titanium-dioxide insulator)

IT 7440-44-0, Carbon, uses

(**nanotubes; top-gate carbon-nanotube**

field-effect transistor with titanium-dioxide insulator)

IT 7429-90-5, Aluminum, uses 7440-21-3, Silicon, uses 7631-86-9,

Silica, uses 13463-67-7, Titanium oxide (TiO₂), uses

(**top-gate carbon-nanotube** field-effect

transistor with titanium-dioxide insulator)

L269 ANSWER 7 OF 30 HCA COPYRIGHT 2004 ACS on STN

138:98706 Interconnection of nanostructures using carbon

nanotubes. Homma, Y.; Yamashita, T.; Kobayashi, Y.; Ogino, T. (NTT Basic Research Laboratories, Nippon Telegraph and Telephone Corporation, Atsugi-shi, Kanagawa, 243-0198, Japan). Physica B: Condensed Matter (Amsterdam, Netherlands), 323(1-4), 122-123 (English) 2002. CODEN: PHYBE3. ISSN: 0921-4526. Publisher: Elsevier Science B.V..

AB The authors propose a novel application of carbon **nanotubes** as wiring material for self-assembling nano-interconnections. They investigated **nanotube** growth on patterned **silicon substrates** as a model for interconnectional growth. The growth was performed by methane CVD deposition with an iron-oxide nanoparticle catalyst. **Nanotubes** originating from the **top** of a mesa grew laterally, bridging one mesa after another. A **nanotube** network was seen among an array of mesas. These results demonstrate the possibility of self-assembled wiring.

CC 76-2 (Electric Phenomena)

ST interconnection nanostructure carbon **nanotube**

IT **Nanotubes**

(carbon; interconnection of nanostructures using carbon

nanotubes)

IT Vapor deposition process

(chem., methane; methane CVD growth of carbon **nanotubes**

- on **silicon substrates** as model for interconnectional growth)
- IT Interconnections, electric Nanostructures
(interconnection of nanostructures using carbon **nanotubes**)
- IT 7440-21-3, Silicon, uses
(methane CVD growth of carbon **nanotubes** on **silicon substrates** as model for interconnectional growth)
- IT 7440-44-0, Carbon, uses
(**nanotubes**; interconnection of nanostructures using carbon **nanotubes**)
- L269 ANSWER 8 OF 30 HCA COPYRIGHT 2004 ACS on STN
138:26392 Liquid phase synthesis of carbon **nanotubes**. Zhang, Y. F.; Gamo, M. N.; Xiao, C. Y.; Ando, T. (c/o Advanced Materials Laboratory (AML), Core Research for Evolutional Science, Technology (CREST) of Japan Science and Technology Corporation (JST), National Institute for Materials Science (NIMS), Tsukuba, Ibaraki, 305-0044, Japan). Physica B: Condensed Matter (Amsterdam, Netherlands), 323(1-4), 293-295 (English) 2002. CODEN: PHYBE3. ISSN: 0921-4526. Publisher: Elsevier Science B.V..
- AB A novel method has been developed for synthesis of aligned carbon **nanotubes** by simply elec. heating a substrate in org. liqs. **Si substrates** with a thin Fe film cover were elec. heated to 500-1000.degree. in org. liq. Aligned multiwalled carbon **nanotubes** were grown and stick well on the **Si substrates** by using methanol and ethanol. The **top ends** of the **nanotubes** were closed with seamless caps. Some other shaped carbon **nanotubes** have also been synthesized, in particular, a special kind of coupled carbon **nanotubes** of which the structure of one carbon **nanotube** is left hand rotated and the other right hand rotated with bridging chains between them. The growth mechanism of carbon **nanotubes** in org. liqs. is proposed to be related to the adsorption and decompn. of org. radicals at the catalytic substrate surface under equil. thermal and dynamic conditions.
- CC 49-1 (Industrial Inorganic Chemicals)
ST carbon **nanotube** liq phase synthesis
IT **Nanotubes**
(carbon; liq. phase synthesis of carbon **nanotubes**)
- IT 7439-89-6, Iron, uses
(liq. phase synthesis of carbon **nanotubes** on **silicon substrate** coated with layer of)
- IT 7440-44-0, Carbon, processes
(**nanotubes**; liq. phase synthesis of carbon **nanotubes**)

IT 7440-21-3, Silicon, uses
(substrate; liq. phase synthesis of carbon
nanotubes on)

L269 ANSWER 9 OF 30 HCA COPYRIGHT 2004 ACS on STN

137:378721 Elec. induced selective breakdown of **nanotubes** in
the fabrication of nanoscale semiconductor devices. Avouris,
Phaedon; Collins, Philip G.; Derycke, Vincent Stephane; Martel,
Richard (International Business Machines Corporation, USA). U.S.
Pat. Appl. Publ. US 2002173083 A1 20021121, 18 pp., Cont.-in-part of
U.S. 6,423,583. (English). CODEN: USXXCO. APPLICATION: US
2002-144402 20020513. PRIORITY: US 2001-753845 20010103.

AB The invention relates to a process for making a nanoscale
semiconductor device. The method provides a substrate, and provides
a plurality of **nanotubes** in contact with the substrate.
The method comprises depositing metal contacts on the
substrate, wherein the **metal** contacts are in
contact with a portion of at least one **nanotube**. The
method further comprises selectively breaking the at least one
nanotube using an elec. current, removing the metal
contacts, cleaning a remaining **nanotube**, and depositing a
first metal contact in contact with a first **end** of the
nanotube and a second metal contact in contact with a second
end of the **nanotube**.

IC ICM H01L021-82

NCL 438129000

CC 76-3 (Electric Phenomena)

ST **nanotube** contact FET CVD annealing

IT **Nanotubes**

(carbon; elec. induced selective breakdown of **nanotubes**
in fabrication of nanoscale semiconductor device)

IT Vapor deposition process

(chem.; elec. induced selective breakdown of **nanotubes**
in fabrication of nanoscale semiconductor device)

IT Annealing

Electric contacts

Field effect transistors

(elec. induced selective breakdown of **nanotubes** in
fabrication of nanoscale semiconductor device)

L269 ANSWER 10 OF 30 HCA COPYRIGHT 2004 ACS on STN

137:208958 An atomic-scale analysis of catalytically-assisted chemical
vapor deposition of carbon **nanotubes**. Grujicic, M.; Cao,
G.; Gersten, Bonnie (Department of Mechanical Engineering, Program
in Materials Science and Engineering, Clemson University, Clemson,
SC, 29634, USA). Materials Science & Engineering, B: Solid-State
Materials for Advanced Technology, B94(2-3), 247-259 (English) 2002.
CODEN: MSBTEK. ISSN: 0921-5107. Publisher: Elsevier Science B.V..

- AB Growth of carbon **nanotubes** during transition-metal particles catalytically-assisted thermal decompn. (also referred to as chem. vapor deposition or CVD) of methane in hydrogen as a carrier gas has been analyzed at the at. scale using a kinetic Monte Carlo method. The method is parameterized by the rates of various **nanotube surface** and edge **reactions** (e.g. adsorption of hydrocarbons and hydrogen onto the surface of the transition-metal particles and onto the surface of carbon **nanotubes**, carbon atom attachment to the growing **end** of **nanotubes**, nucleation and growth of the outer **nanotubes** walls, etc.). Simulations of the carbon **nanotubes** growth are found to yield predictions regarding the effect of nominal and local processing conditions on the **nanotubes** morphol. and growth rates in very good (qual. and quant.) agreement with their exptl. counterparts. In addn., formation of new walls during growth is found to take place quite readily suggesting that the fabrication of single walled carbon **nanotubes** by CVD may be a formidable task.
- CC 76-2 (Electric Phenomena)
- ST catalytic chem vapor deposition carbon **nanotube**
- IT Simulation and Modeling, physicochemical
(Monte Carlo; study of growth of carbon **nanotubes** during transition metal catalyzed thermal decompn. of methane in hydrogen using kinetic Monte Carlo method)
- IT **Nanotubes**
(carbon; at.-scale anal. of catalytically-assisted chem. vapor deposition of carbon **nanotubes**)
- IT Vapor deposition process
(chem.; at.-scale anal. of catalytically-assisted chem. vapor deposition of carbon **nanotubes**)
- IT Transition metals, uses
(study of growth of carbon **nanotubes** during transition metal catalyzed thermal decompn. of methane in hydrogen using kinetic Monte Carlo method)
- IT 74-82-8, Methane, processes
(study of growth of carbon **nanotubes** during transition metal catalyzed thermal decompn. of methane in hydrogen using kinetic Monte Carlo method)
- IT 1333-74-0, Hydrogen, uses
(study of growth of carbon **nanotubes** during transition metal catalyzed thermal decompn. of methane in hydrogen using kinetic Monte Carlo method)

L269 ANSWER 11 OF 30 HCA COPYRIGHT 2004 ACS on STN

137:147492 Selective-area growth of indium nitride **nanowires**

on gold-patterned **Si(100) substrates**. Liang, C.

H.; Chen, L. C.; Hwang, J. S.; Chen, K. H.; Hung, Y. T.; Chen, Y. F.

(Center for Condensed Matter Sciences, National Taiwan University,

Taipei, Taiwan). Applied Physics Letters, 81(1), 22-24 (English) 2002. CODEN: APPLAB. ISSN: 0003-6951. Publisher: American Institute of Physics.

- AB This letter reports the synthesis of In nitride (InN) **nanowires** on Au-patterned **Si substrates** in a controlled manner using a method involving thermal evapn. of pure In. The locations of these InN **nanowires** were controlled by depositing Au in desired areas on the substrates. SEM and TEM studies showed that the InN **nanowires** are single crystals with diams. ranging from 40 to 80 nm, and lengths up to 5 .mu.m. Energy dispersive x-ray spectrometry showed that the **ends** of the **nanowires** are composed primarily of Au, and the rest of the **nanowires** were InN with no detectable Au incorporations. The Raman spectra showed peaks at 445, 489, and 579 cm⁻¹, which are attributed to the A1(transverse optical), E2, and A1(longitudinal optical) phonon modes of the wurtzite InN structure, resp. Photoluminescence spectra of the InN **nanowires** showed a strong broad emission peak at 1.85 eV.
- CC 73-11 (Optical, Electron, and Mass Spectroscopy and Other Related Properties)
Section cross-reference(s): 75
- ST indium nitride **nanowire** gold silicon
- IT Luminescence
Quantum wire devices
Raman spectra
Scanning electron microscopy
Transmission electron microscopy
X-ray spectroscopy
(selective-area growth of indium nitride **nanowires** on gold-patterned **Si(100) substrates**)
- IT 7440-21-3, Silicon, uses 25617-98-5, Indium nitride
(selective-area growth of indium nitride **nanowires** on gold-patterned **Si(100) substrates**)

L269 ANSWER 12 OF 30 HCA COPYRIGHT 2004 ACS on STN

- 137:87369 Shaping carbon **nanotubes** with chemistry. Sano, Masahito; Kamino, Ayumi; Okamura, Junko; Shinkai, Seiji (Chemotransfiguration Project - JST, Fukuoka, 839-0861, Japan). Journal of Inclusion Phenomena and Macrocyclic Chemistry, 41(1-4), 49-52 (English) 2001. CODEN: JIPCF5. ISSN: 1388-3127. Publisher: Kluwer Academic Publishers.
- AB A review. As-grown, string-shaped single-walled carbon **nanotubes** were transformed into other shapes by applications of org. chem. Cutting carbon **nanotubes** in strong acids affords O-contg. groups at both ends of the open tubes. These groups were used for ring-closure reactions in very dil. conditions. At. force microscopy reveals ring-shaped **nanotubes** with a mean diam. of 540 nm as products. Also, the end groups were used to

react with the **surface** amine groups of PAMAM dendrimer. It gave star-shaped structures in which straight **nanotubes** are radiating from dendrimer centers. These expts. clearly demonstrate that covalent chem. is useful for construction of super-structured carbon **nanotubes**.

CC 78-0 (Inorganic Chemicals and Reactions)

Section cross-reference(s): 28, 35

ST review carbon **nanotube** dispersion functionalization shaping superstructure; ring closure functionalized single walled carbon **nanotube** review; star superstructure carbon **nanotube** dendrimer deriv review

IT **Nanotubes**

(carbon; dispersion, **end**-functionalization and subsequent shaping of single-walled carbon **nanotubes**)

IT Polyamines

(polyamide-, dendrimers; reaction of end-functionalized single-walled carbon **nanotubes** with PAMAM dendrimer to give star-shaped structures)

IT Dendritic polymers

(polyamide-polyamines; reaction of end-functionalized single-walled carbon **nanotubes** with PAMAM dendrimer to give star-shaped structures)

IT Polyamides, reactions

(polyamine-, dendrimers; reaction of end-functionalized single-walled carbon **nanotubes** with PAMAM dendrimer to give star-shaped structures)

IT Cyclization

Ring (molecular)

(ring-closure reactions of end-functionalized single-walled carbon **nanotubes** to give ring superstructures)

IT 26937-01-9, PAMAM

(dendritic; reaction of end-functionalized single-walled carbon **nanotubes** with amine-terminated generation 10 PAMAM dendrimers to give star-shaped superstructures)

L269 ANSWER 13 OF 30 HCA COPYRIGHT 2004 ACS on STN

137:8182 A novel synthesis method for aligned carbon **nanotubes** in organic liquids. Zhang, Yafei; Nishitani-Gamo, Mikka; Xiao, Changyong; Ando, Toshihiro (Core Research for Evolutional Science and Technology (CREST), National Institute for Materials Science (NIMS), Japan Science and Technology Corporation (JST), Tsukuba, 305-0044, Japan). Japanese Journal of Applied Physics, Part 2: Letters, 41(4A), L408-L411 (English) 2002. CODEN: JAPL D8. Publisher: Japan Society of Applied Physics.

AB Aligned carbon **nanotube** arrays have been grown on **Si substrates** in methanol by using a hot-substrate method. Samples were grown in a glass chamber equipped with a function in which methanol and ethanol vapors were condensed by

means of water-cooling. **Si substrates** with a thin Fe film were elec. heated to 930.degree.C in liq. methanol. Hollow multiwalled carbon **nanotubes** standing well on the **Si substrates** were obtained with external diams. ranging from 13 to 26 nm and lengths up to 20 .mu.m, with the ratio of tube radius to the thickness of tube shells ranging from 1.7 to 2.1. The **top ends** of the **nanotubes** were closed with nearly seamless caps. The mechanism of **nanotube** growth is a catalytic process at the substrate surface under thermal non-equil.

CC 49-1 (Industrial Inorganic Chemicals)

ST carbon **nanotube** synthesis org liq; methanol carbon **nanotube** synthesis; ethanol carbon **nanotube** synthesis

IT 7440-44-0P, Carbon, preparation

(**nanotubes**; synthesis of aligned carbon **nanotube** array grown on iron-coated **silicon substrates** in org. liqs. by hot-substrate method)

IT 64-17-5, Ethanol, uses 67-56-1, Methanol, uses 7440-21-3, Silicon, uses

(synthesis of aligned carbon **nanotube** array grown on iron-coated **silicon substrates** in org. liqs. by hot-substrate method)

IT 7439-89-6, Iron, uses

(synthesis of aligned carbon **nanotube** array grown on iron-coated **silicon substrates** in org. liqs. by hot-substrate method)

L269 ANSWER 14 OF 30 HCA COPYRIGHT 2004 ACS on STN

136:410317 Growth and characterization of magnetic nanostructures on carbon **nanotube** templates. Wu, Yihong; Qiao, Peiwen; Chong, Towchong (Department of Electrical and Computer Engineering, National University of Singapore, Singapore, 117576, Singapore). Materials Research Society Symposium Proceedings, 676(Synthesis, Functional Properties and Applications of Nanostructures), Y5.7.1-Y5.7.7 (English) 2002. CODEN: MRSPDH. ISSN: 0272-9172. Publisher: Materials Research Society.

AB We describe the growth of magnetic nanostructures on C **nanotube** templates. The **nanotubes** were grown by microwave plasma enhanced CVD. The as grown **nanotubes** were aligned reasonably well around the substrate normal directions. Although the **nanotubes** were quite straight, there were still some bent and tilt as revealed by SEM observations. Magnetic field was used to re-align or re-assemble the **nanotubes** before they were used as the templates to grow magnetic nanostructures. Depending on whether there is a magnetic particle on the **top tip** of each **nanotube** and the d. of the **nanotubes**, there are 2 different consequences of

applying a magnetic field to the **nanotubes**. For **nanotubes** with magnetic particles attached to their top tips, the post-growth treatment by the magnetic field resulted in re-assembly of the **nanotubes** into micro-umbrella type of structures. For those without magnetic particles, however, the effect of magnetic field treatment is negligible; but after the deposition of thin magnetic layers, the field treatment made the **nanotubes** much straighter than what they originally were and aligned almost vertically to the substrates. The re-aligned or re-assembled **nanotubes** were used as the templates to grow magnetic nanostructures. Most of the magnetic nanostructures exhibited characteristics similar to those of magnetic **nanowires**.

- CC 77-1 (Magnetic Phenomena)
Section cross-reference(s): 75
- ST CVD growth magnetic nanostructure carbon **nanotube** template
microstructure magnetism
- IT Coercive force (magnetic)
Magnetic hysteresis
Microstructure
(PECVD growth and structural and magnetic characterization of
magnetic nanostructures on C **nanotube** templates)
- IT **Nanotubes**
(carbon; PECVD growth and structural and magnetic
characterization of magnetic nanostructures on C **nanotube**
templates)
- IT Nanostructures
(magnetic; PECVD growth and structural and magnetic
characterization of magnetic nanostructures on C **nanotube**
templates)
- IT Vapor deposition process
(plasma; PECVD growth and structural and magnetic
characterization of magnetic nanostructures on C **nanotube**
templates)
- IT 7440-44-0, Carbon, properties
(**nanotubes**; PECVD growth and structural and magnetic
characterization of magnetic nanostructures on C **nanotube**
templates)
- IT 11148-32-6
(substrate and coating on C **nanotubes**; PECVD growth and
structural and magnetic characterization of magnetic
nanostructures on C **nanotube** templates)
- IT 7429-90-5, Aluminum, uses 7440-21-3, Silicon,
uses 7440-25-7, Tantalum, uses 7440-50-8, Copper, uses
11110-23-9
(**substrate**; PECVD growth and structural and magnetic
characterization of magnetic nanostructures on C **nanotube**
templates)

L269 ANSWER 15 OF 30 HCA COPYRIGHT 2004 ACS on STN

136:371791 Surface modifications of single-wall carbon **nanotubes**. Tiano, Thomas; Roylance, Margaret; Smith, Ken (Foster-Miller, Inc., Waltham, MA, 02451, USA). Proceedings of the American Society for Composites, Technical Conference, 16th, 307-316 (English) 2001. CODEN: PAMTEG. ISSN: 1084-7243. Publisher: CRC Press LLC.

AB A review of the state of the art and a summary of current work. To manuf. high performance nanocomposites comprising single-wall C **nanotubes** (**SWNT**) in org. matrixes that take advantage of the unique mech. and phys. properties of the **nanotubes**, there are 2 hurdles. Firstly strong van der Waals forces cause SWNTs to agglomerate in bundles (called ropes) and secondly, smooth **nanotube** surfaces interact only weakly with polymeric matrixes. If surface modification techniques are developed that can enhance **SWNT** dispersion and interaction with org. matrixes, the revolutionary properties of C **nanotubes** can be harnessed for nanocomposite reinforcement. Early **nanotube** research focused on functionalization through the carboxylic acid **SWNT end** groups, but modification of the **SWNT end** groups alone will not provide sufficient compatibility to allow significant load transfer from org. matrixes to the body of the SWNTs. Sidewall functionalization performed by different methods, including fluorination followed by alkyl-lithiation, and free-radical reaction, also was employed for surface modification and should lead to enhanced load transfer. This approach may enhance mech. properties of **SWNT** composites, but it modifies the **SWNT** electronic structure and disrupts their elec. cond. It is therefore not indicated for applications that depend upon the thermal and elec. cond. of the **nanotube** filler. Surface compatibilization shows the highest promise as a method for increasing dispersion and load transfer for such applications. Previous work has achieved marked improvement in de-agglomeration of **SWNT** ropes, but known compatibilizers work primarily in H2O and do not lend themselves to transfer into org. matrixes. The study of polymeric dispersants for use in org. solvents is pursued.

CC 49-0 (Industrial Inorganic Chemicals)

Section cross-reference(s): 66, 78

ST review surface modification carbon **nanotube** polymeric dispersant

IT **Nanotubes**

(carbon; surface modifications of single-wall carbon **nanotubes**)

IT **Surface reaction**

(**surface** modifications of single-wall carbon **nanotubes**)

IT 7440-44-0, Carbon, processes

(**nanotubes**; surface modifications of single-wall carbon
nanotubes)

L269 ANSWER 16 OF 30 HCA COPYRIGHT 2004 ACS on STN

136:78054 High-current field emission from a vertically aligned carbon **nanotube** field emitter array. Thong, J. T. L.; Oon, C. H.; Eng, W. K.; Zhang, W. D.; Gan, L. M. (Centre for Integrated Circuit Failure Analysis and Reliability (CICFAR), Faculty of Engineering, National University of Singapore, Singapore, 117576, Singapore). Applied Physics Letters, 79(17), 2811-2813 (English) 2001. CODEN: APPLAB. ISSN: 0003-6951. Publisher: American Institute of Physics.

AB Arrays of vertically aligned C **nanotubes** (CNTs) were grown on a patterned sputtered Co film by CVD from ethylenediamine at 900.degree.. Each square array comprises a moderate d. of **nanotubes** with an av. height of 90 .mu.m covering a total area of 3.6 .times. 10⁻³ cm². Field emission measurements were carried out on individual arrays at pressures <10⁻⁸ mbar. The spacing between the anode and the **top** of the **CNT** array is 935 .mu.m and a total current of 2 mA could be obtained at 2.5 kV. A Fowler-Nordheim plot of the I-V data shows an unusually high field enhancement factor at lower fields. At an av. field strength of 1.925 V/.mu.m, the corresponding emission c.d. is 130 mA/cm². This emission current is very stable, with short-term fluctuations (5 Hz measurement bandwidth) of no more than .+-.1.5%, while the current drifted <1.5% over a test period of 20 h.

CC 76-11 (Electric Phenomena)

ST field emission carbon **nanotube** array cobalt film

IT **Nanotubes**

(carbon; high-current field emission from vertically aligned carbon **nanotube** field emitter array prepd. by CVD from ethylenediamine on patterned and sputtered cobalt catalyst layers)

IT Vapor deposition process

(chem.; high-current field emission from vertically aligned carbon **nanotube** field emitter array prepd. by CVD from ethylenediamine on patterned and sputtered cobalt catalyst layers)

IT Field emission

Field emission cathodes

Sputtering

Thermal decomposition catalysts

(high-current field emission from vertically aligned carbon **nanotube** field emitter array prepd. by CVD from ethylenediamine on patterned and sputtered cobalt catalyst layers)

IT 7440-48-4, Cobalt, properties

(high-current field emission from vertically aligned carbon **nanotube** field emitter array prepd. by CVD from

- ethylenediamine on patterned and sputtered cobalt catalyst layers)
- IT 7440-44-0P, Carbon, processes
(high-current field emission from vertically aligned carbon **nanotube** field emitter array prepd. by CVD from ethylenediamine on patterned and sputtered cobalt catalyst layers)
- IT 107-15-3, Ethylenediamine, reactions
(high-current field emission from vertically aligned carbon **nanotube** field emitter array prepd. by CVD from ethylenediamine on patterned and sputtered cobalt catalyst layers)
- IT 7440-21-3, Silicon, processes 7440-57-5, Gold, processes
(**substrate**; high-current field emission from vertically aligned carbon **nanotube** field emitter array prepd. by CVD from ethylenediamine on patterned and sputtered cobalt catalyst layers)
- L269 ANSWER 17 OF 30 HCA COPYRIGHT 2004 ACS on STN
135:232983 Electrochemical intercalation of lithium into raw carbon **nanotubes**. Yang, Z.-h.; Wu, H.-q. (Department of Chemistry, Fudan University, Shanghai, 200433, Peop. Rep. China). Materials Chemistry and Physics, 71(1), 7-11 (English) 2001. CODEN: MCHPDR. ISSN: 0254-0584. Publisher: Elsevier Science S.A..
- AB The results of the electrochem. intercalation of Li into raw carbon **nanotubes** in 1 M LiClO₄ EC/DEC (50:50) are presented. The correlation between structure and charge-discharge characteristics of the raw carbon **nanotubes** produced by arc discharge method was examd.; the carbon **nanotubes** with closed **ends** possess a reversible capacity of 125 mA h g⁻¹. Surface film formation occurred during the first discharge at 0.8 V vs. Li⁺/Li. Taking into account the difficulty of Li intercalation into the layers or hollows of the end-closed tubes, a surface mechanism is proposed in which the naked surfaces of the carbon **nanotubes** and carbon nanoparticles are capable of storing Li species.
- CC 72-2 (Electrochemistry)
Section cross-reference(s): 57
- ST lithium electrochem intercalation carbon **nanotube**
- IT **Nanotubes**
(carbon; electrochem. intercalation of lithium into raw carbon **nanotubes**)
- IT Intercalation
(electrochem.; electrochem. intercalation of lithium into raw carbon **nanotubes**)
- IT **Reaction** mechanism
(**surface**; of electrochem. intercalation of lithium into

- raw carbon **nanotubes**)
- IT 7439-93-2, Lithium, processes
(electrochem. intercalation of lithium into raw carbon
nanotubes)
- IT 7791-03-9, Lithium perchlorate
(electrolyte; electrochem. intercalation of lithium into raw
carbon **nanotubes** from)

L269 ANSWER 18 OF 30 HCA COPYRIGHT 2004 ACS on STN

135:13232 Manufacture of cold cathodes. Oki, Hiroshi; Urayama, Masao
(Sharp Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2001155620 A2
20010608, 7 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP
1999-332675 19991124.

AB Gate insulator layers and gate electrodes are formed on
metal substrates, while cathodes are formed on the
substrate bottom, and the **bottom ends** of
nano-tubes which penetrate the substrates and the
gate insulator layers are inserted into the cathodes.

IC ICM H01J001-304

ICS H01J009-02

CC 76-12 (Electric Phenomena)

ST cold cathode gate insulator layer **nanotube**

IT Dielectric films

Field emission cathodes

Nanotubes

(manuf. of cold cathodes with **nanotubes** penetrating
metal substrates and gate insulator layers)

IT Metals, uses

(manuf. of cold cathodes with **nanotubes** penetrating
metal substrates and gate insulator layers)

L269 ANSWER 19 OF 30 HCA COPYRIGHT 2004 ACS on STN

134:303557 Growth mechanism of vertically aligned carbon
nanotubes on **silicon substrates**. Choi,
Y. C.; Kim, D. W.; Lee, T. J.; Lee, C. J.; Lee, Y. H. (Department of
Semiconductor Science and Technology, Department of Physics and
Semiconductor Physics Research Center, Chonbuk National University,
Jeonju, 561-756, S. Korea). Synthetic Metals, 117(1-3), 81-86
(English) 2001. CODEN: SYMEDZ. ISSN: 0379-6779. Publisher:
Elsevier Science S.A..

AB The authors have synthesized vertically aligned carbon
nanotubes by thermal CVD deposition using C₂H₂ gas on a
large area of transition **metal-coated Si**
substrates. It is obsd. that control of nucleation sites of
transition metals deposited on **Si substrates** by
dipping in a HF soln. and/or NH₃ pretreatment is a crucial step for
the growth of vertically aligned carbon **nanotubes** prior to
the reaction of C₂H₂ gas. The authors show that the transition

metals play as nucleation seeds and lead to further cap growth by forming a metal cap at the **end of nanotubes**.

CC 76-2 (Electric Phenomena)

ST thermal CVD carbon **nanotube silicon**
substrate

IT **Nanotubes**

(carbon; growth mechanism of vertically aligned carbon
nanotubes on silicon substrates)

IT Vapor deposition process

(chem., thermal; growth mechanism of vertically aligned carbon
nanotubes on silicon substrates)

IT 7440-21-3, Silicon, uses

(growth mechanism of vertically aligned carbon **nanotubes**
on **silicon substrates**)

L269 ANSWER 20 OF 30 HCA COPYRIGHT 2004 ACS on STN

134:229780 Electron gun, its production, and field emission display.

Matsumoto, Kazuhiko; Uchiyama, Tetsuo (K and T K. K., Japan). Jpn.

Kokai Tokkyo Koho JP 2001068016 A2 20010316, 8 pp. (Japanese).

CODEN: JKXXAF. APPLICATION: JP 1999-245033 19990831.

AB An electron gun comprises an emitter substrate having a sharp top
edge on which C **nanotube** is directly vapor-phase grown.

The **top** of the C **nanotube** projects over the
top of the emitter substrate. A field-emission display is
equipped with the electron gun. In prodn. of the electron gun, the
C **nanotube** is directly vapor-phase grown by decompn. of a
C-contg. gas upon heating. Preferably, the substrate surface is
previously soaked in a soln. contg. a chloride before the vapor
deposition to readily form C **nanotube**. The C
nanotube having sharp edge (1-10 nm) works as Spindt-type
emitter and shows low work function works.

IC ICM H01J001-304

ICS G09F009-30; H01J009-02; H01J029-04; H01J031-12; C01B031-02

CC 74-13 (Radiation Chemistry, Photochemistry, and Photographic and
Other Reprographic Processes)

Section cross-reference(s): 75, 76

ST field emission electron gun emitter; carbon **nanotube**

electron gun emitter; vapor deposition carbon **nanotube**

electron gun; Spindt emitter carbon **nanotube** electron gun

IT Vapor deposition process

(carbon **nanotube**; vapor phase growth of C
nanotube on electron gun emitter surface and field
emission display)

IT **Nanotubes**

(carbon, emitter; vapor phase growth of C **nanotube** on
electron gun emitter surface and field emission display)

IT Field emission cathodes

(electron gun; vapor phase growth of C **nanotube** on

- electron gun emitter surface and field emission display)
- IT Electron sources
(emitter; vapor phase growth of C **nanotube** on electron gun emitter surface and field emission display)
- IT 74-82-8, Methane, processes 74-84-0, Ethane, processes 74-98-6, Propane, processes
(C **nanotube** source; vapor phase growth of C **nanotube** on electron gun emitter surface and field emission display)
- IT 7705-08-0, Ferric chloride, uses 7758-94-3, Ferrous chloride 10026-04-7, **Silicon** chloride 63451-54-7, Molybdenum chloride oxide
(emitter **surface** treatment agent; in vapor phase growth of C **nanotube** on electron gun emitter surface and field emission display)
- L269 ANSWER 21 OF 30 HCA COPYRIGHT 2004 ACS on STN
134:36067 Nanometer-scale microscopy probes. Lieber, Charles M.; Wong, Stanislaus S.; Woolley, Adam T.; Joselevich, Ernesto (President and Fellows of Harvard College, USA). U.S. US 6159742 A 20001212, 10 pp. (English). CODEN: USXXAM. APPLICATION: US 1999-326100 19990604. PRIORITY: US 1998-PV122051 19980605.
- AB Carbon-based tips for scanning probe microscopy used to reveal chem. characteristics of a sample are described which comprise X-(L-M)_n (n = 1-100; X = a carbon-based **nanotube** having a first **end** and a second end; L = a linking group bonded at the first end of the carbon-based **nanotube**; and M = a mol. probe bonded to the linking group, the second end of the carbon-based **nanotube** being adapted for attachment to a cantilever configured for microscopy). Methods of probing a sample by scanning probe microscopy are described which entail providing a carbon-based **nanotube** having a mol. probe linked to one end of the carbon-based **nanotube**; and sensing the surface of the sample with the mol. probe to reveal the chem. characteristics of the sample. Methods of removing a mol. probe from a carbon-based tip for use in scanning probe microscopy are also described which entail providing a carbon-based tip which includes a carbon-based **nanotube** and a mol. probe linked to one end of the carbon-based **nanotube**; providing a **metal surface** near the first mol. probe; and applying a voltage between the carbon-based **nanotube** and the **metal surface** to remove the mol. probe.
- IC ICM G01N021-00
ICS G01N033-544
- NCL 436164000
- CC 76-14 (Electric Phenomena)
Section cross-reference(s): 9, 79, 80
- ST functionalized carbon **nanotube** tip scanning probe

- microscope
- IT **Nanotubes**
(carbon; functionalized carbon **nanotube**-based tips for scanning probe microscopy)
- IT Scanning probe microscopes
(functionalized carbon **nanotube**-based tips for scanning probe microscopy)
- IT 100-46-9D, Benzylamine, reaction products with carbon **nanotubes** 107-15-3D, Ethylenediamine, reaction products with carbon **nanotubes** 2564-86-5D, Carboxyl, reaction products with carbon **nanotubes** 3352-57-6D, Hydroxyl, reaction products with carbon **nanotubes**, uses 115416-38-1D, 5-(Biotinamido)pentylamine, reaction products with carbon **nanotubes**
(functionalized carbon **nanotube**-based tips for scanning probe microscopy)
- IT 7440-44-0, Carbon, uses
(**nanotubes**; functionalized carbon **nanotube**-based tips for scanning probe microscopy)
- L269 ANSWER 22 OF 30 HCA COPYRIGHT 2004 ACS on STN
132:328267 Crossed **nanotube** junctions. Fuhrer, M. S.; Nygard, J.; Shih, L.; Forero, M.; Yoon, Young-Gui; Mazzoni, M. S. C.; Choi, Hyounghoon; Ihm, Jisoon; Louie, Steven G.; Zettl, A.; McEuen, Paul L. (Department of Physics, University of California at Berkeley, Berkeley, CA, 94720, USA). Science (Washington, D. C.), 288(5465), 494-497 (English) 2000. CODEN: SCIEAS. ISSN: 0036-8075. Publisher: American Association for the Advancement of Science.
- AB Junctions consisting of 2 crossed single-walled carbon **nanotubes** were fabricated with elec. contacts at each end of each **nanotube**. The individual **nanotubes** were identified as metallic (M) or **semiconducting** (S), based on their 2-terminal conductances; MM, MS, and SS 4-terminal devices were studied. The MM and SS junctions had high conductances, on the order of $0.1 e^2/h$ (where e is the electron charge and h is Planck's const.). For an MS junction, the semiconducting **nanotube** was depleted at the junction by the metallic **nanotube**, forming a rectifying Schottky barrier. Two- and three-terminal expts. were used to fully characterize this junction.
- CC 76-3 (Electric Phenomena)
- ST current voltage relationship conductance crossed carbon **nanotube** junction
- IT **Nanotubes**
(carbon; elec. characteristics of crossed carbon **nanotube** junctions)
- IT Electric contacts
Semiconductor junctions

- (elec. characteristics of crossed carbon **nanotube** junctions)
- IT Electric conductivity
Electric current-potential relationship
(of crossed carbon **nanotube** junctions)
- IT 7440-44-0, Carbon, properties
(elec. characteristics of crossed carbon **nanotube** junctions)
- L269 ANSWER 23 OF 30 HCA COPYRIGHT 2004 ACS on STN
132:224821 Manufacture of carbon **nanotube** for use in electricity discharge-type cold cathode device. Chou, Li; Sakai, Tadashi; Ono, Tomio; Sakuma, Hisashi (Toshiba Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2000086216 A2 20000328, 11 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1998-255515 19980909.
- AB In the metal catalyst dot made from magnetic material is exposed on the **substrate** of a **semiconductor**, a metal, or an insulator, and a magnetic field is implied to the substrate surface in vertical direction to cause the growth of carbon **nanotube** with the metal catalyst dot remained on the **top** of the carbon **nanotube** to form the emitter electrode. Sufficient voltage is applied to the individual emitter to obtain large stabilized discharge elec. current.
- IC ICM C01B031-02
ICS C23C016-26; H01J001-304; H01J009-02
- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
- ST carbon **nanotube** metal catalyst tip emitter electrode;
field emission cold cathode manuf
- IT **Nanotubes**
(carbon; manuf. of carbon **nanotube** for use in electricity discharge-type cold cathode device)
- IT Field emission cathodes
(manuf. of carbon **nanotube** for use in electricity discharge-type cold cathode device)
- IT 7439-89-6, Iron, uses 7440-47-3, Chromium, uses
(dot; manuf. of carbon **nanotube** for use in electricity discharge-type cold cathode device)

- L269 ANSWER 24 OF 30 HCA COPYRIGHT 2004 ACS on STN
132:53641 Process and device for manufacturing orderly arranged carbon **nanotube**. Xie, Sishen; Li, Wenzhi (Physics Institute, Chinese Academy of Sciences, Peop. Rep. China). Faming Zhuanli Shenqing Gongkai Shuomingshu CN 1165209 A 19971119, 15 pp. (Chinese). CODEN: CNXXEV. APPLICATION: CN 1996-120461 19961105.
- AB The process comprises dissolving chloride, nitrate, or oxalate of transition metal in water to prep. a soln. (0.1-2M), dropping the soln. into hot water (50-80.degree.) to prep. sol (0.1-2M), mixing the soln. or the sol with Et silicate and ethanol at a mol ratio of

(8-16):1:(4-6), adding HF or HCl, stirring for 15-30 min to obtain SiO₂ sol, solidifying to obtain SiO₂ gel, drying at 40-70.degree. for 7-10 d, heating at 350-500.degree. and 10⁻¹-10⁻² torr for 10-15 h in C **nanotube** growth chamber, reducing with a mixed gas of H₂ and N₂ at 450-550.degree. and 100-300 torr for 5-10 h to obtain SiO₂ **substrate** with transition **metal** nanometer particles (catalyst for the growth of C **nanotube**) in the substrate micropores, heating the substrate to 600-700.degree., and introducing a mixed gas of acetylene and N₂ (acetylene/N₂ vol ratio (1-2):10; flow velocity 80-150 mL/min) for 1-5 h. The SiO₂ substrate may also be prepd. by dropping SiO₂ sol onto quartz **wafer** or **metal** sheet to form a layer of SiO₂ gel film, drying at 20-30.degree. for 3-5 d, heating in C **nanotube** growth chamber at 450.degree. and 10⁻² torr for 10 h, and reducing with a mixed gas of H₂ and N₂ at 550.degree. and 180 torr for 5 h. The transition metal may be Fe, Co, Ni, etc. The device consists of furnace body, gas distributing system, and vacuum system; the furnace body consists of heater, C **nanotube** growth chamber made of stainless steel or quartz set in the heater, temp. controlling device, sample rod, and thermoelec. couple in the sample rod; the gas distributing system consists of gas path and gas mass flowmeter connected with one **end** of the C **nanotube** growth chamber; the vacuum system is connected with the other end of the nanometer growth chamber through pressure adjusting valve and butterfly valve. The length of the prepd. metallic, semimetallic, or nonmetallic C **nanotube** is 20-100 .mu.m, diam. is 7-30 nm, and purity of the tube is .gtoreq.99%.

- IC ICM C30B029-02
- ICS C30B029-66
- CC 57-8 (Ceramics)
- ST carbon **nanotube** manuf silica catalyst support; transition metal catalyst carbon **nanotube** manuf
- IT **Nanotubes**
 (carbon; process and device for manufg. orderly arranged carbon **nanotube**)
- IT Transition metals, uses
 (catalyst; process and device for manufg. orderly arranged carbon **nanotube**)
- IT 7631-86-9P, Silica, preparation
 (catalyst support; process and device for manufg. orderly arranged carbon **nanotube**)
- IT 547-67-1, Nickel oxalate 2944-66-3, Ferric oxalate 7439-89-6, Iron, uses 7440-02-0, Nickel, uses 7440-48-4, Cobalt, uses 7646-79-9, Cobalt chloride, uses 7705-08-0, Ferric chloride, uses 7718-54-9, Nickel chloride, uses 10141-05-6, Cobalt nitrate 10421-48-4, Ferric nitrate 13138-45-9, Nickel nitrate 134761-87-8, Cobalt oxalate

- (catalyst; process and device for manufg. orderly arranged carbon **nanotube**)
- IT 7440-44-0P, Carbon, preparation
(process and device for manufg. orderly arranged carbon **nanotube**)
- IT 74-86-2, Acetylene, processes
(process and device for manufg. orderly arranged carbon **nanotube**)
- IT 11099-06-2, Ethyl silicate
(process and device for manufg. orderly arranged carbon **nanotube**)
- L269 ANSWER 25 OF 30 HCA COPYRIGHT 2004 ACS on STN
132:43950 Dissolution of single-walled carbon **nanotubes**.
Hamon, Mark A.; Chen, Jian; Hu, Hui; Chen, Yongsheng; Itkis, Misha E.; Rao, Apparao M.; Eklund, Peter C.; Haddon, Robert C. (Dep. Chem., Center Applied Energy, Univ. Kentucky, Lexington, KY, 40506, USA). Advanced Materials (Weinheim, Germany), 11(10), 834-840 (English) 1999. CODEN: ADVMEW. ISSN: 0935-9648. Publisher: Wiley-VCH Verlag GmbH.
- AB The soly. properties of single-walled C **nanotubes** (SWNTs) and the factors that control the dissoln. of these materials were investigated. During synthesis, the purifn. and shortening processes terminate the open ends of the SWNTs with carboxylic acid groups. These are converted to acyl chlorides, that on reaction with the alkyl-aryl amine 4-dodecylaniline gave amides/imides. These SWNTs have lengths of .ltoreq.300 nm, contain .apprxeq.50,000 C atoms, 25,000 benzenoid rings, and have a mol. wt. of .apprxeq.600,000 D. The SWNTs were characterized by 1H-NMR, IR, Raman, and AFM. Further expts. were performed to det. the limits of sol. **SWNT** fabrication: (i) **end-group** derivatization of purified but unshortened SWNTs (only 5% of the final product was sol. in CH₂Cl₂), (ii) direct reaction of the amine with the shortened **SWNT-COOH** (the obtained SWNTs were sol. in THF, due to zwitterion formation by the acid-**base reaction** of carboxylic acid and amine), and (iii) reaction of the shortened **SWNT-COOH** with aniline (product insol. in CH₂Cl₂).
- CC 78-1 (Inorganic Chemicals and Reactions)
Section cross-reference(s): 66, 68
- ST soly single wall carbon **nanotube** amidation
- IT **Nanotubes**
(carbon, single-walled; soly. enhancement of amide derivatized single-walled C **nanotubes**)
- IT Amidation
Solubility
(soly. enhancement of single-walled C **nanotubes** by reaction to amides with long alkyl chains and to zwitterions)

- through acid-**base reaction**)
- IT 124-30-1, Octadecylamine 91323-12-5, 4-Tetradecylaniline
(derivatization of single-walled carbon **nanotubes** for
soly. enhancement)
- IT 7440-44-0, Carbon, reactions
(soly. enhancement of single-walled C **nanotubes** by
reaction to amides with long alkyl chains and to zwitterions
through acid-**base reaction** studied via IR,
Raman, and NMR spectra)
- L269 ANSWER 26 OF 30 HCA COPYRIGHT 2004 ACS on STN
131:109685 Bias-enhanced nucleation and growth of the aligned carbon
nanotubes with open **ends** under microwave plasma
synthesis. Tsai, S. H.; Chao, C. W.; Lee, C. L.; Shih, H. C.
(Department of Materials Science and Engineering, National Tsing Hua
University, Hsinchu, 300, Taiwan). Applied Physics Letters, 74(23),
3462-3464 (English) 1999. CODEN: APPLAB. ISSN: 0003-6951.
Publisher: American Institute of Physics.
- AB Aligned carbon **nanotubes** with open **ends** have
been fabricated on **silicon wafer** in one step
using a microwave plasma enhanced chem. vapor deposition system with
a mixt. of methane and hydrogen as precursors. High concn. hydrogen
plasma and high neg. bias voltage to the substrate induce
anisotropic etching of carbon **nanotubes** and can
effectively reduce the randomly oriented carbon **nanotubes**.
The mechanism of aligned carbon **nanotubes** with open
ends is proposed in this letter.
- CC 76-11 (Electric Phenomena)
ST nucleation growth carbon **nanotube** microwave plasma
IT Etching
(anisotropic; bias-enhanced nucleation and growth of aligned
carbon **nanotubes** with open **ends** under
microwave plasma synthesis)
- IT Crystal nucleation
Microwave
Plasma
(bias-enhanced nucleation and growth of aligned carbon
nanotubes with open **ends** under microwave plasma
synthesis)
- IT **Nanotubes**
(carbon; bias-enhanced nucleation and growth of aligned carbon
nanotubes with open **ends** under microwave plasma
synthesis)
- IT Vapor deposition process
(plasma; bias-enhanced nucleation and growth of aligned carbon
nanotubes with open **ends** under microwave plasma
synthesis)
- IT 7440-44-0, Carbon, processes

- (bias-enhanced nucleation and growth of aligned carbon **nanotubes** with open **ends** under microwave plasma synthesis)
- IT 7440-21-3, Silicon, properties
(bias-enhanced nucleation and growth of aligned carbon **nanotubes** with open **ends** under microwave plasma synthesis)
- IT 74-82-8, Methane, reactions 1333-74-0, Hydrogen, reactions
(bias-enhanced nucleation and growth of aligned carbon **nanotubes** with open **ends** under microwave plasma synthesis)
- L269 ANSWER 27 OF 30 HCA COPYRIGHT 2004 ACS on STN
130:201273 Simulations of carbon **nanotube** tip assisted mechano-chemical reactions on a diamond surface. Dzegilenko, Fedor N.; Srivastava, Deepak; Saini, Subhash (IT Modeling and Simulation Group at NAS/MRJ, NASA Ames Research Center, Moffett Field, CA, 94035, USA). Nanotechnology, 9(4), 325-330 (English) 1998. CODEN: NNOTER. ISSN: 0957-4484. Publisher: Institute of Physics Publishing.
- AB The interaction of a carbon **nanotube** tip with two chem. modified caps with a single-height-stepped C{001} (2.times.1) diamond surface is studied by performing mol. dynamics simulations. The C2 and C6H2 radicals are attached to the **end** cap of a **nanotube**. The forces for solving the classical equations of motion are derived from Brenner's many-body reactive potential. Depending on the surface impact site, the **nanotube** initial velocity towards the diamond surface, and the **nanotube** withdrawal rate a variety of mechano-chem. reactions have been obsd. The strong tip-surface interaction results in creation of chem. different nanostructures on the diamond surface for C6H2 tip, while the tip with C2 allows us to remove a dimer of carbon atoms from the upper terrace of diamond. The possibility of using a **nanotube** with chem. modified caps for selective etching and nanolithog. on different **semiconductor surfaces** is discussed.
- CC 66-3 (Surface Chemistry and Colloids)
Section cross-reference(s): 47, 65, 73
- ST diamond mechanochem reaction carbon **nanotube** tip radicals
SPM
- IT Potential energy
(Brenner's many body reactive potential used in study carbon **nanotube** tip assisted mechanochem. **reactions** on diamond **surface**)
- IT **Nanotubes**
(carbon; simulations of carbon **nanotube** SPM tip assisted mechanochem. reactions on diamond single-height-stepped C{001} (2.times.1) surface)

- IT Mechanochemical reaction
(dynamics; simulations of carbon **nanotube** SPM tip assisted mechanochem. reactions on diamond single-height-stepped C{001}(2.times.1)surface)
- IT Simulation and Modeling, physicochemical
(mol. dynamics; interaction of carbon **nanotube** SPM tip with attached C2 and C6H2 radicals with single-height-stepped C{001}(2.times.1) diamond surface studied by mol. dynamics simulations)
- IT Surface structure
(simulations of carbon **nanotube** SPM tip assisted mechanochem. reactions in relation to diamond single-height-stepped C{001}(2.times.1)surface)
- IT **Reaction mechanism**
(**surface**; simulations of carbon **nanotube** SPM tip assisted mechanochem. reactions in relation to diamond single-height-stepped C{001}(2.times.1)surface)
- IT 12070-15-4, Carbon dimer
(interaction of carbon **nanotube** SPM tip with attached C2 and C6H2 radicals with single-height-stepped C{001}(2.times.1) diamond surface studied by mol. dynamics simulations)
- IT 107019-11-4, 1,2,3-Cyclohexatrien-5-yne
(interaction of carbon **nanotube** SPM tip with attached C2 and C6H2 radicals with single-height-stepped C{001}(2.times.1) diamond surface studied by mol. dynamics simulations)
- IT 7782-40-3, Diamond, properties
(simulations of carbon **nanotube** SPM tip assisted mechanochem. reactions on diamond single-height-stepped C{001}(2.times.1)surface)

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128:329438 Fabrication of twin nano **silicon** wires

based on arsenic dopant effect. Tang, Xiaohui; Baie, Xavier; Colinge, Jean-Pierre (Univ. Catholique Louvain DICE, Louvain-la-Neuve, 1348, Belg.). Japanese Journal of Applied Physics, Part 1: Regular Papers, Short Notes & Review Papers, 37(3B), 1591-1593 (English) 1998. CODEN: JAPNDE. ISSN: 0021-4922. Publisher: Japanese Journal of Applied Physics.

AB This paper reports a simple fabrication process of Si "twin **nano wires**" based on As dopant effect which gives rise to a significant increase of the oxidn. rate at the peak concn. of As. The processing procedures consist of As doping, deposition of silicon nitride layer, electron beam lithog., reactive ion etching, wet oxide and deposition of polysilicon. The resulting Si "twin **nano wires**" have a small top wire with a dimension of 10 nm and a triangular channel wire with a height of 250 nm. A possible application of the "twin **nano wires**" to a future single-electron memory device on silicon

on insulator (SOI) wafer is also discussed.

CC 76-3 (Electric Phenomena)

IT Sputtering
(etching, reactive; fabrication of twin nano **silicon**
wires **based** on arsenic dopant effect)

IT Dopants
Electron beam lithography
Wires
(fabrication of twin nano **silicon** wires **based**
on arsenic dopant effect)

IT Etching
(sputter, reactive; fabrication of twin nano **silicon**
wires **based** on arsenic dopant effect)

IT 7440-21-3, Silicon, uses 7440-38-2, Arsenic, uses 12033-89-5,
Silicon nitride, uses
(fabrication of twin nano **silicon** wires **based**
on arsenic dopant effect)

L269 ANSWER 29 OF 30 HCA COPYRIGHT 2004 ACS on STN

126:53846 Single-electron devices and their preparation. Moskovits,
Martin; Xu, Jing M. (Moskovits; Martin, Can.; Xu; Jing M.). U.S. US
5581091 A 19961203, 8 pp. (English). CODEN: USXXAM. APPLICATION:
US 1994-352151 19941201.

AB Single-electron devices useful as diodes, transistors, or other
electronic components are prep'd. by anodizing a **metal**
substrate in sheet or foil form electrolytically in an acid
bath, to deposit on it an oxide film having axially disposed
micropores of substantially uniform diam. in the range .apprx.1-500
nm and substantially uniform depth less than the thickness of the
oxide film, leaving an ultrathin oxide layer between the bottom of
each pore in the **metal substrate**. Conductive
material is deposited in the pores to form **nanowires**
contacting the oxide layer at the bottom of the pores. Macro metal
is deposited over the **ends** of the **nanowires** for
external elec. contact purposes. Devices can be made according to
the present invention which are suitable to exhibit single-electron
tunneling effects, and arrays of tunnel junction devices can be
prep'd. having a d. up to the order of 10^{10} cm⁻².

IC ICM H01L029-06
ICS H01L021-302

NCL 257009000

CC 76-3 (Electric Phenomena)

L269 ANSWER 30 OF 30 HCA COPYRIGHT 2004 ACS on STN

125:236108 Single-electron devices and their manufacture. Moskovits,
Martin; Xu, Jing M. (Can.). Can. Pat. Appl. CA 2137013 AA 19960531,
23 pp. (English). CODEN: CPXXEB. APPLICATION: CA 1994-2137013
19941130.

AB Single-electron devices useful as diodes, transistors, or other electronic components are prepd. by anodizing a **metal substrate** in sheet or foil form electrolytically in an acid bath, to deposit an oxide film having axially disposed micropores of substantially uniform diam. of .apprx.1-500 nm and substantially uniform depth less than the thickness of the oxide film, leaving an ultrathin oxide layer between the bottom of each pore and the **metal substrate**. The conductive material is deposited in the pores to form **nanowires** contacting the oxide layer at the bottom of the pores. Macro metal is deposited over the **ends** of the **nanowires** for external elec. contact purposes. Devices can be made according to the present invention which are suitable to exhibit single-electron tunneling effects, and arrays of tunnel junction devices can be prepd. having a d. up to the order of 10^{10} cm⁻².

IC ICM H01L029-86

CC 76-3 (Electric Phenomena)

ST single electron device manuf; **nanowire** single electron device manuf; diode single electron device manuf; transistor single electron device manuf

IT Electric conductors
(deposition of conductive material in pores in manuf. of **nanowire** single-electron devices)

IT Oxides, processes
(deposition of porous oxide films in manuf. of **nanowire** single-electron devices)

IT Anodization
(in manuf. of **nanowire** single-electron devices)

IT Semiconductor junctions
(tunnel, manuf. of arrays of tunnel junction devices contg. **nanowires**)

IT Aluminum alloy, base
Niobium alloy, base
Tantalum alloy, base
Titanium alloy, base
(manuf. of **nanowire** single-electron devices on substrates from)

IT 7429-90-5, Aluminum, processes 7440-03-1, Niobium, processes
7440-25-7, Tantalum, processes 7440-32-6, Titanium, processes
(manuf. of **nanowire** single-electron devices on substrates from)

IT 7440-02-0, Nickel, processes
(manuf. of single-electron devices having **nanowires** from)